

Recovery Strategy for the Woodland Caribou, Southern Mountain population (*Rangifer tarandus caribou*) in Canada

Woodland Caribou, Southern Mountain population



2014

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Note: The Woodland Caribou, Southern Mountain population is referred to as “southern mountain caribou” in this document.

¹ www.registrelep.gc.ca/default_e.cfm

PREFACE

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (Government of Canada 1996) agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA) (Government of Canada 2002), the federal competent ministers are responsible for the preparation of recovery strategies for listed Extirpated, Endangered, and Threatened species and are required to report on progress five years after the publication of the final document on the Species at Risk Public Registry (Government of Canada 2013).

The Minister of the Environment and the Minister responsible for the Parks Canada Agency are the competent ministers under SARA for southern mountain caribou. The Minister of the Environment led the preparation of this recovery strategy as per section 37 of SARA. To the extent possible, it has been prepared in cooperation with the Provinces of British Columbia and Alberta as per section 39(1) of SARA.

Success in the recovery of southern mountain caribou depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Environment Canada, the Parks Canada Agency, or any other jurisdiction alone. The Provinces of British Columbia and Alberta, Aboriginal peoples, industry and others play an important role in managing natural resources and wildlife where southern mountain caribou are found. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the southern mountain caribou population and Canadian society as a whole.

This recovery strategy will be followed by one or more action plans that will provide information on recovery measures to be taken by Environment Canada, the Parks Canada Agency and other jurisdictions and/or organizations involved in the recovery of the species. Implementation of this strategy is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

ACKNOWLEDGMENTS

A draft recovery strategy was begun by Lucy Reiss and furthered by Greg Ferguson, both of Environment Canada. Darcy Peel of Environment Canada led the preparation of the proposed version with contracted assistance from Deborah Cichowski, Glenn Sutherland and Scott McNay. Advice and information used to prepare this strategy was obtained from staff of the Parks Canada Agency, the Provinces of British Columbia and Alberta, and Environment Canada, in addition to input from various experts on caribou.

EXECUTIVE SUMMARY

This recovery strategy is for the Woodland Caribou (*Rangifer tarandus caribou*), Southern Mountain population herein referred to as “southern mountain caribou”, assessed in May 2002 as threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Southern mountain caribou occur in the southern two-thirds of British Columbia (BC) and in west-central Alberta, with one subpopulation ranging into northern Idaho and Washington in the United States.

The geographic area occupied by a subpopulation (individual herd) is referred to as a range. Southern mountain caribou subpopulations and their ranges have been defined based on extensive studies of movements and seasonal habitat use of radio-collared caribou. In some areas, subpopulations have been organized into local population units, which reflect likely larger historical subpopulations that have since declined and that have been fragmented into the currently recognized subpopulations. Southern mountain caribou are currently distributed across 35 subpopulations, comprising 24 local population units. Most subpopulations have undergone long-term declines in numbers. The current overall number of southern mountain caribou is estimated to be approximately 6,000. Three Groups of southern mountain caribou are recognized based on ecological and evolutionary distinctions between them: the Northern Group in west-central and north-central BC; the Central Group in east-central BC and west-central Alberta; and, the Southern Group in southeastern BC.

Southern mountain caribou occupy ranges consisting of highly diverse topography, terrain types, and environmental conditions. They require large range areas of relatively undisturbed, interconnected habitat where they can separate themselves (horizontally and by elevation) from predators and other prey species, can modify their use of habitat in response to various natural and human-caused habitat disturbances and human activities, and can access their preferred food sources. During winter, southern mountain caribou require large patches of mature and old forests with abundant lichens.

In the Southern Group where the snowpack is deep, caribou predominantly use high elevation mature and old subalpine forests in mid and late winter where they forage on arboreal lichens. During early winter before snow has consolidated, and during spring, they use lower elevation mature and old forests (with some subpopulations moving down into cedar/hemlock forests in valley bottoms). In the Central and Northern groups, caribou live in relatively shallow snow areas where they forage primarily on terrestrial lichens either in low elevation mature coniferous forests or on windswept alpine slopes during winter. They also forage on arboreal lichens in low elevation forests, forested wetlands, and in subalpine habitats. Many subpopulations in the Northern and Central Groups travel long distances between winter and summer ranges, while others winter and summer within the same general area. Most southern mountain caribou calve in high elevation habitats. Southern mountain caribou require their different seasonal ranges to be connected by lands that facilitate their movement. These lands, termed ‘matrix range’, need to provide some forage, security from human disturbance, and a low risk of predation.

Due to the specific life history characteristics they possess, southern mountain caribou are limited in their potential to recover from rapid, severe population declines. Habitat alteration (i.e., habitat loss, degradation, and fragmentation) from both human-caused and natural sources, and increased predation as a result of habitat alteration, have led to declining numbers throughout their distribution. Threats are closely interrelated and act together to have direct or indirect impacts on southern mountain caribou and their habitat. Recovery of all southern mountain caribou local population units is technically and biologically feasible.

The recovery goal for southern mountain caribou is to achieve self-sustaining populations in all local population units within their current distribution, to the extent possible. Achieving this recovery goal for all local population units will take a number of decades, especially for local population units where levels of disturbance are high.

To guide recovery efforts, the population and distribution objectives are, to the extent possible, to:

- stop the decline in both size and distribution of all local population units;
- maintain or increase the current distribution of southern mountain caribou within all local population units; and,
- increase the size and distribution of all local population units to self-sustaining levels and, where appropriate and attainable, to levels which can sustain a harvest with dedicated or priority access to aboriginal peoples.

Performance indicators are identified as a means by which progress towards achieving the population and distribution objectives can be measured.

The critical habitat necessary to achieve the population and distribution objectives for the recovery and survival of southern mountain caribou is partially identified in this strategy. Critical habitat for southern mountain caribou is identified as: i) all of the area of high elevation winter and/or summer range within the boundary of each local population unit; ii) the area within the boundary of each local population unit in the Northern and Central Groups that contains low elevation winter range that provides an overall ecological condition that will allow for an ongoing recruitment and retirement cycle of habitat, which maintains a perpetual state of a minimum of 65% of the area as undisturbed; iii) the area within the boundary of each local population unit that contains matrix range that provides an overall ecological condition that will allow for low predation risk defined as wolf population densities less than 3 wolves/1000 km²; and, iv) biophysical attributes required by southern mountain caribou to carry out life processes.

The threshold of a minimum of 65% undisturbed area within low elevation winter ranges is taken from analyses undertaken for boreal caribou ranges. While this approach can be considered as use of best available information, a schedule of studies is included in this strategy to acquire information specific to southern mountain caribou to determine the level of undisturbed habitat in seasonal and matrix ranges that are required to sustain recruitment and reduce adult mortality.

The recovery of southern mountain caribou requires actions that will vary according to both the habitat and population conditions within each local population unit. This recovery strategy provides broad strategies and general approaches to achieve the population and distribution objectives, which will assist in the development of subsequent action plans.

As required by SARA, the Minister of the Environment and the Minister Responsible for the Parks Canada Agency will complete one or more action plans under this recovery strategy. These plans will provide detailed information on recovery measures and will be posted on the Species at Risk Public Registry within three years.

RECOVERY FEASIBILITY SUMMARY

Recovery of southern mountain caribou is considered to be both technically and biologically feasible across the species' distribution in Canada based on the following four criteria outlined in the draft SARA Policies (Government of Canada, 2009).

Current evidence supports the conclusion that the recovery of all local population units is biologically and technically feasible. However, small local population units, and particularly those isolated from the core distribution of the southern mountain caribou population, are at greater risk of not becoming self-sustaining. In these situations, a local population unit may have greater difficulty withstanding threats such as increased predation resulting from altered predator/prey dynamics due to human-caused and natural disturbances, and random events, and may not experience enough immigration to maintain genetic diversity and therefore will be at greater risk of not persisting in the long-term. Over time and through unforeseen circumstances, there may be situations where recovery of a particular local population unit proves not to be biologically or technically feasible. This would affect the likelihood of achieving the population and distribution objectives.

1. Individuals of the wildlife species that are capable of reproduction are available now or in the foreseeable future to sustain the population or improve its abundance.

Yes. According to current best estimates, there are approximately 6000 southern mountain caribou across British Columbia and Alberta. These animals are capable of successful reproduction and are available to improve local population unit growth rates and abundance, thereby achieving self-sustainability.

2. Sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration.

Yes. Some local population units of southern mountain caribou have sufficient suitable habitat within their ranges. For other local population units where sufficient suitable habitat is currently unavailable, sufficient habitat could be made available through habitat management or restoration.

3. The primary threats to the species or its habitat (including threats outside Canada) can be avoided or mitigated.

Yes. The primary threat to most local population units of southern mountain caribou is unnaturally high predation rates as a result of human-caused and natural habitat loss, degradation, and fragmentation. These habitat alterations support conditions that favour higher alternate prey densities (e.g., moose [*Alces americanus*], deer [*Odocoileus* spp.], elk [*Cervus elaphus*]), resulting in increased predator populations (e.g., wolf [*Canis lupus*], bear [*Ursus* spp.]) that in turn increase the risk of predation to southern mountain caribou. This threat can be mitigated through coordinated land and/or resource planning, and habitat restoration and management, in conjunction with predator and alternate prey management where local population unit conditions warrant such action.

4. Recovery techniques exist to achieve the population and distribution objectives or can be expected to be developed within a reasonable timeframe.

Yes. Recovery techniques (e.g., protection and management of forested habitat, habitat restoration, predator and alternate prey management, hunting regulations, stewardship initiatives) are available to achieve the population and distribution objectives for southern mountain caribou. There is uncertainty with regard to the effectiveness of some of these techniques, as they have not yet undergone a sufficiently long trial period.

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1 COSEWIC² SPECIES ASSESSMENT INFORMATION

Date of Assessment: May 2002

Common Name (population): Woodland Caribou (Southern Mountain population)

Scientific Name: *Rangifer tarandus caribou*

COSEWIC Status: Threatened

Reason for Designation: Local herds in the Southern Mountain population are generally small, increasingly isolated, and subject to multiple developments. Their range has shrunk by up to 40% and 13 of 19 herds are declining. The most southerly herds are likely to disappear. Many herds are threatened by decreasing habitat quantity and quality, harassment, and predation.

Canadian Occurrence: British Columbia (BC) and Alberta

COSEWIC Status History: The Southern Mountain population was designated threatened in May 2000. This population was formerly designated as part of the "Western population" (now de-activated). Status was re-examined and confirmed in May 2002.

2 SPECIES STATUS INFORMATION

The Woodland Caribou, Southern Mountain population (*Rangifer tarandus caribou*), herein referred to as "southern mountain caribou", is listed as threatened (2003) under Canada's *Species at Risk Act* (SARA) (Government of Canada 2013).

Southern mountain caribou are essentially endemic to Canada and occur in BC and Alberta, with one subpopulation ranging into northern Idaho and Washington in the United States (US). NatureServe ranks southern mountain caribou as imperilled to critically imperilled at the national level (Table 1), but has not ranked southern mountain caribou at the global level (NatureServe 2013). In Alberta, southern mountain caribou are ranked as critically imperilled and are designated as Threatened under Alberta's *Wildlife Act*. In BC, the "northern" ecotype is ranked as vulnerable and the "mountain" ecotype is ranked as critically imperilled. The "northern" ecotype is on the BC Conservation Data Centre's (CDC) Blue list (special concern) and the "mountain" ecotype is on the Red list (threatened/endorsed). Caribou in Idaho and Washington are ranked critically imperilled, and were listed as Endangered in 1984 by the US Fish and Wildlife Service under the US *Endangered Species Act*.

² COSEWIC (Committee on the Status of Endangered Wildlife in Canada)

Table 1. Status ranks for southern mountain caribou.

NatureServe Ranks		Canadian status	Provincial status
National (N)	Sub-national (S)		
Canada (N1N2) ¹ US (N1N2)	AB (S1) ² BC (S1 – mountain) BC (S3 – northern) Idaho (S1) Washington (S1)	SARA – Schedule 1 (Threatened)	BC (Red – mountain) BC (Blue – northern) AB (Threatened)

¹ N1N2 = imperilled to critically imperilled

³ S1 = critically imperilled; S3 = vulnerable

3 SPECIES INFORMATION

In Canada, four subspecies of caribou are currently recognized: Woodland Caribou (*R. t. caribou*); Peary Caribou (*R. t. pearyi*); Barren-ground Caribou (*R. t. groenlandicus*); and Grant's Caribou (*R. t. granti*; Banfield 1961). Dawson's Caribou (*R. t. dawsoni*) occurred on Haida Gwaii (i.e., Queen Charlotte Islands, BC) before their extinction in the early 1900s (Spalding 2000). Although Banfield's (1961) subspecies classification is commonly used, a review and revision of the taxonomy of caribou is needed (COSEWIC 2011).

Based on the classification system used by COSEWIC in its 2002 assessment, Woodland Caribou are separated into six geographically distinct populations in Canada: Northern Mountain, Southern Mountain, Boreal, Forest-tundra, Atlantic-Gaspésie, and Newfoundland (COSEWIC 2002). This recovery strategy addresses the recovery of the southern mountain population of caribou in Canada, which is located within the Southern Mountains National Ecological Area of BC and Alberta (SMNEA; Thomas and Gray 2002).

Two “ecotypes” of caribou are recognized by the provinces within the SMNEA. These ecotypes broadly reflect adaptive behaviours of caribou (e.g., feeding, migration) to a variety of ecological conditions (e.g., amount and duration of snow cover, topography/terrain). In BC, caribou that live in areas of relatively shallow snowpack and which feed primarily on terrestrial lichens are called ‘northern’ ecotype caribou, while caribou that live in deep snow areas and feed primarily on arboreal lichens are ‘mountain’ ecotype caribou (Stevenson and Hatler 1985, Heard and Vagt 1998). In Alberta, caribou that feed primarily on terrestrial lichens and spend at least part of their annual cycle in the mountains are similar to BC's ‘northern’ ecotype but are called ‘mountain’ caribou (ASRD&ACA 2010).

In 2011, COSEWIC defined 12 Designatable Units (DUs) for caribou across Canada. DUs are discrete and evolutionarily significant units of caribou defined to address issues with the current taxonomy and with classification of ecotypes (COSEWIC 2011). That report splits caribou in the SMNEA into 3 DUs: Northern Mountain (DU7), Central Mountain (DU8), and Southern Mountain (DU9). The SMNEA includes all of DU8 and DU9, but only the southern portion of DU7. The DU structure for caribou in western

Canada is currently being reviewed as part of the update to the COSEWIC status report and subsequent reassessment in 2014.

In order to retain the ecological and evolutionary distinction between the 3 DUs, and to avoid confusion with the naming of ecotypes, subpopulations of southern mountain caribou in the Northern Mountain (DU7), Central Mountain (DU8) and Southern Mountain (DU9) will be referred to as the Northern Group, Central Group and Southern Group respectively (Table 2) in this recovery strategy.

Table 2. Relationship of provincial, SARA and COSEWIC designations for southern mountain caribou. Grey shading indicates southern mountain caribou.

Terrain/ Winter feeding strategy	Ecotype name	Location	Nationally Significant Population by National Ecological Area (SARA)	COSEWIC Designatable Unit	Southern mountain caribou Groupings
Shallow snow/ terrestrial lichen	BC: Northern AB: Mountain	Northern BC	Northern Mountain	Northern Mountain	N/A ¹
		West central BC	Southern Mountain		Northern Group
		North central BC		Central Mountain	Central Group
		East central BC			
		West central Alberta			
Deep snow/ arboreal lichen	BC: Mountain	Southeastern BC	Southern Mountain	Southern Group	

¹ Not applicable

3.1 Species Description

Like all Woodland Caribou, southern mountain caribou are a medium-sized (1.0-1.2 m shoulder height and weighing 110-210 kg) member of the deer family (*Cervidae*) (Thomas and Gray, 2002). Adults have a dark brown coat with a creamy white neck, mane, shoulder stripe, underbelly, underside of the tail, and patch above each hoof (Banfield, 1974). Caribou have large, rounded hooves and large, widely spaced dew claws which help them walk on and dig through snow to gain access to lichens, their primary food during winter (Thomas and Gray 2002). As a unique feature among the deer family, both male and female caribou have antlers during part of the year, although some females may have only one antler or no antlers at all (Thomas and Gray, 2002). Antlers are erect and spreading with males having a flattened brow tine that points down over the forehead (BC Ministry of Environment, Lands and Parks, 2000).

3.2 Population and Distribution

3.2.1 Subpopulations and Local Population Units

In this strategy, the term “subpopulation” refers to individual herds and “range” refers to the geographic area occupied by a subpopulation. Range is also further defined by season (e.g., winter range). Southern mountain caribou subpopulations and their ranges

have been defined based on extensive studies of movements and seasonal range use of radio-collared caribou (e.g., Cichowski 1993, Terry and Wood 1999, Young and Roorda 1999, Poole et al. 2000, Young et al. 2001, Roberts et al. 2003, Culling et al. 2005, Wittmer et al. 2005a, Jones 2007, ASRD&ACA 2010, van Oort et al. 2011, Williamson-Ehlers 2012, Seip and Jones 2013). Many of those radio-telemetry studies were conducted after the 1980s with some initiated as recently as 2002. For those subpopulations, ranges often reflect current distribution and habitat use, and may not adequately describe historically used range and seasonal range use patterns. The only subpopulation with limited information on habitat use and distribution is the Scott subpopulation.

In some areas, subpopulations have been organized into local population units which reflect likely larger historical subpopulations that have since declined and that have been fragmented into the currently recognized subpopulations. For subpopulations that are not grouped with other subpopulations into a larger local population unit, the local population unit is equivalent to the subpopulation.

3.2.2 Distribution

Southern mountain caribou are distributed across 35 extant subpopulations, comprising 24 local population units in the southern two-thirds of BC and in the west-central portion of Alberta (Figure 1). One subpopulation range (South Selkirks) also extends partially into northern Idaho and Washington, U.S.A. Historically, caribou in the SMNEA ranged further south and occupied a much larger area than they do currently (Figures 1, 2). In BC, a conservative estimate of range contraction for all caribou types since the arrival of Europeans is 20%, with the major change in distribution occurring in the southern portion of the province in the SMNEA in the past 50 years. Hummel and Ray (2008) report that southern mountain caribou have been extirpated from approximately 40% of their historical range due to loss and change in habitats, primarily resulting from human activities. In Alberta, about 61% of the generalized maximum historical range of all caribou in the province is no longer occupied (Dzus 2001). Southern mountain caribou also occurred in most of the northwestern US states in the 19th century but are now extirpated (the last confirmed sighting of a caribou in Montana was in 1958), except for the South Selkirk subpopulation (US Fish and Wildlife Service 1993). However, the most recent census of this subpopulation indicated that it is both small (estimate of 33 in 2013) and declining, raising concerns about the likelihood of the US range being occupied in the future (BC Ministry of Forests, Lands and Natural Resource Operations, unpublished data).

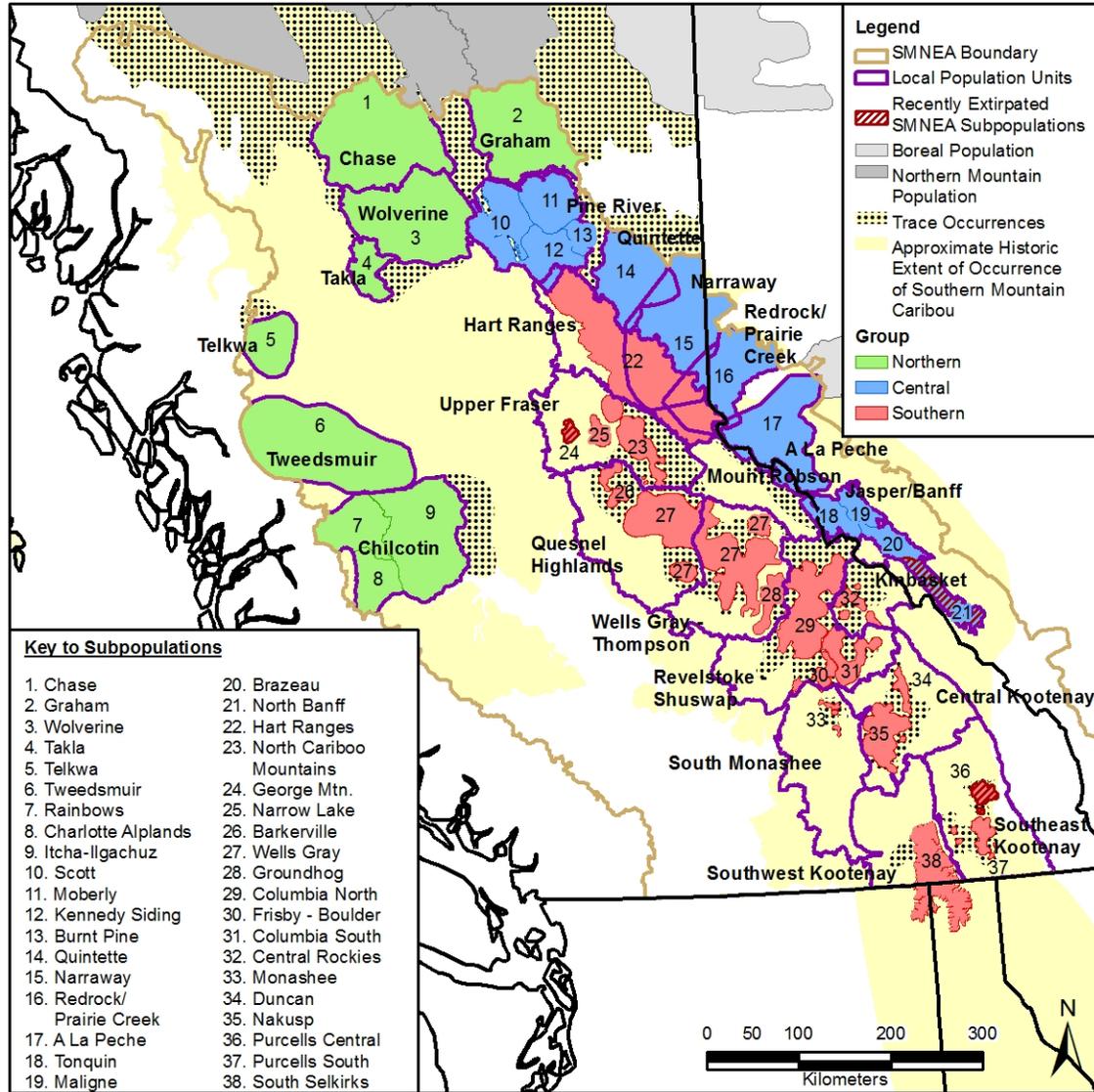


Figure 1. Current distribution of southern mountain caribou subpopulations and local population units.

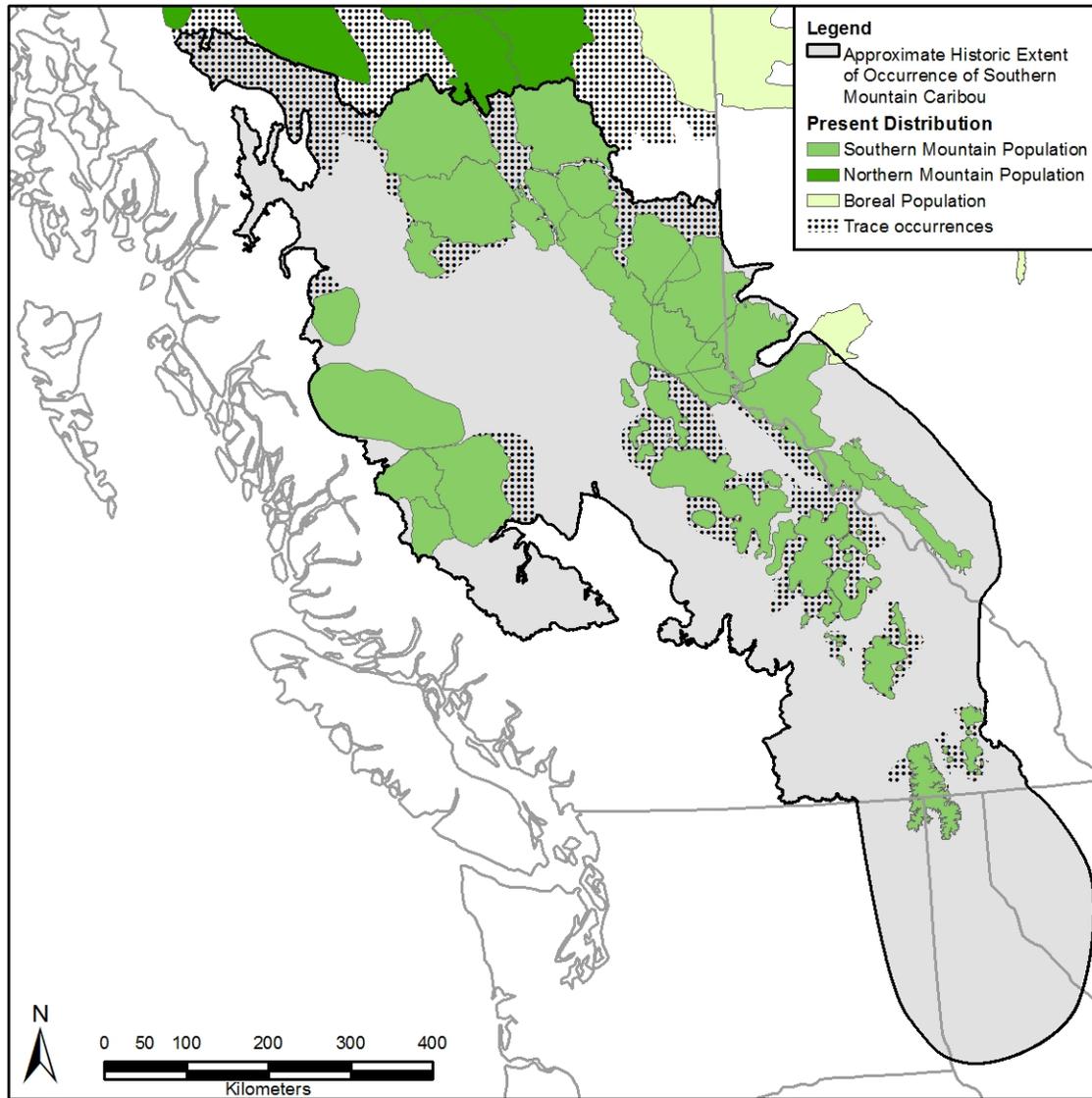


Figure 2. Current distribution and approximate historical extent of occurrence of southern mountain caribou; parts of adjacent Boreal and Northern Mountain Caribou population ranges are also shown.

3.2.3 Population numbers and trends

Reliable current population size and trend information is available for most southern mountain caribou subpopulations. For some subpopulations, however, a large proportion of the caribou is found below treeline during all seasons, making them difficult to census.

In the Northern Group, censuses for the Itcha-Ilgachuz and Telkwa subpopulations date back to the 1970s and 1960s respectively. Fewer population estimates are available for the other subpopulations. However, population trend information is available for some subpopulations based on survey data, or on radio-collared caribou mortality rates and calf recruitment.

In the Central Group, censuses of the Kennedy Siding, Burnt Pine, Moberly, Quintette and the eastern portion of the Scott subpopulations are conducted during late winter when caribou are using high elevation alpine and subalpine habitat (Seip and Jones 2013). Censuses of the Tonquin, Brazeau and Maligne subpopulations are conducted in the fall when caribou are using high elevation alpine habitat. No reliable censuses have been conducted for the Narraway, Redrock-Prairie Creek and A La Peche subpopulations because many of the caribou in those subpopulations use low elevation forested habitat during winter, making them difficult to count. Population trends for subpopulations in the Central Group are based on mortality rates of radio-collared caribou and late winter calf recruitment counts. These have been tracked annually since at least 2002/03 for most subpopulations and as far back as 1998/99 for the Redrock Prairie Creek and A La Peche subpopulations (ASRD&ACA 2010, Seip and Jones 2013, AESRD unpublished data).

In the Southern Group, population surveys are conducted during late winter when caribou are using high elevation subalpine habitat. Numerous surveys have been conducted for all subpopulations since the early 1990s.

Based on the best available information, the current overall number of southern mountain caribou in Canada is estimated to be approximately 6,000 (Table 3). Other than the Itcha-Ilgachuz and Graham subpopulations, all subpopulations are estimated to consist of fewer than 500 caribou. Half (18 of 35) of the extant subpopulations consist of 50 or fewer caribou. All but two of the subpopulations with known long-term trends have declined, and three of those are currently extirpated.

Table 3. Population size and trend information for southern mountain caribou subpopulations in Canada.

# ¹	Prov	Subpopulation	Local population unit	Population estimate ²		Population Trend ³	
				Estimate	Year	Current	Long-term
<i>Northern Group</i>							
1	BC	Chase	Chase	475	2009	Unknown	Unknown
2	BC	Graham	Graham	708	2009	Stable	Unknown
3	BC	Wolverine	Wolverine	341	2010	Unknown	Decreasing
4	BC	Takla	Takla	122	2004	Unknown	Unknown
5	BC	Telkwa	Telkwa	40	2011	Decreasing	Decreasing
6	BC	Tweedsmuir	Tweedsmuir	300	2002	Decreasing	Decreasing
7	BC	Rainbows	Chilcotin	50	2008	Decreasing	Decreasing
8	BC	Charlotte Alplands		7	2012	Decreasing	Decreasing
9	BC	Itcha-Ilgachuz		1700	2012	Decreasing	Increasing ⁴
	BC	Northern Group Total		3743		Unknown	Unknown
<i>Central Group</i>							
10	BC	Scott	Pine River	47	2013 ⁵	Unknown	Unknown
11	BC	Moberly		16	2013	Decreasing	Decreasing
12	BC	Kennedy Siding		41	2012	Decreasing	Decreasing
13	BC	Burnt Pine		1	2013	Decreasing	Decreasing

# ¹	Prov	Subpopulation	Local population unit	Population estimate ²		Population Trend ³	
				Estimate	Year	Current	Long-term
14	BC	Quintette	Quintette	129	2013	Decreasing	Decreasing
15	BC/ AB	Narraway	Narraway	96 ⁶	2012	Decreasing	Decreasing
16	AB	Redrock/Prairie Creek	Redrock/Prairie Creek	127 ⁶	2012	Decreasing	Decreasing
17	AB	A La Peche	A La Peche	88 ⁶	2012	Decreasing	Decreasing
18	AB	Tonquin	Jasper/Banff	38	2013	Decreasing	Decreasing
19	AB	Maligne		5	2013	Decreasing	Decreasing
20	AB	Brazeau		8	2013	Decreasing	Decreasing
21	AB	Banff ⁷		0			
	BC/ AB	Central Group Total		596		Decreasing	Decreasing
Southern Group							
22	BC	Hart Ranges	Hart Ranges	459	2013	Decreasing	Decreasing
23	BC	North Cariboo Mountains	Upper Fraser	222	2011	Decreasing	Decreasing
24	BC	George Mountain ⁸		0			Decreasing
25	BC	Narrow Lake		42	2012	Stable	Decreasing
26	BC	Barkerville	Quesnel Highlands	90	2012	Increasing	Increasing
27	BC	Wells Gray (North) ⁹		259	2013	Decreasing	Decreasing
		Wells Gray (South) ⁹	Wells Gray-Thompson	133	2013	Decreasing	Decreasing
28	BC	Groundhog		13	2013	Decreasing	Decreasing
29	BC	Columbia North	Revelstoke-Shuswap	183	2013	Stable	Decreasing
30	BC	Frisby-Boulder		13	2013	Decreasing	Decreasing
31	BC	Columbia South		7	2013	Decreasing	Decreasing
32	BC	Central Rockies	Kinbasket	3	2008	Decreasing	Decreasing
33	BC	Monashee	South Monashee	4	2011	Decreasing	Decreasing
34	BC	Duncan	Central Kootenay	2	2012	Decreasing	Decreasing
35	BC	Nakusp		105	2012	Stable	Decreasing
36	BC	Purcells Central ¹⁰	Southeast Kootenay	0			Decreasing
37	BC	Purcells South		21	2013	Stable	Decreasing
38	BC	South Selkirks	Southwest Kootenay	33	2013	Decreasing	Decreasing
	BC		Mount Robson ¹¹	0		N/A	N/A
	BC	Southern Group Total		1589		Decreasing	Decreasing
SMNEA Total				5928			

¹ Number corresponds to subpopulation number in Figure 1

² Population estimates based on survey data unless otherwise noted and includes all age classes

³ Long-term trend based on a three generation (27 years) trend based on survey data for Southern and Northern Groups, and on population vital rates (radio-collared adult mortality, late winter calf recruitment) for Central Group and Tweedsmuir subpopulation of the Northern Group; current trend based on interviews with jurisdictional experts

⁴ Although the long term trend is a net increase, the population has declined approximately 42% from its peak in 2003 to 2012 (COSEWIC *in draft*)

⁵ A survey was conducted for the eastern portion of the Scott subpopulation in 2013, but the west side was estimated in 2007 based on anecdotal sightings

⁶ Population estimates based on 2009 population estimate of 100 caribou for the Narraway, 212 caribou for the Redrock-Prairie Creek and 135 caribou for the A La Peche subpopulations (ASRD&ACA 2010) and

then extrapolated to 2012 using annual lambdas from Alberta Ministry of Environment and Sustainable Resource Development (unpublished data)

⁷ Extirpated in 2009

⁸ Extirpated in 2003; range no longer managed for caribou

⁹ Although Wells Gray is currently recognized as one subpopulation, the northern portion is included in the Quesnel Highlands local population unit and the southern portion is included in the Wells Gray – Thompson local population unit.

¹⁰ Extirpated in 2005

¹¹ The Mount Robson local population unit includes only small portions of the Central Group's Tonquin and A La Peche subpopulation ranges; population size and trend estimates for those subpopulations are included in the Central Group

Caribou population estimates for the entire province of BC were in the range of 30,000-40,000 at the turn of the 20th century (Spalding 2000). Relative population changes suggest a general declining trend until about the 1940s, followed in some cases by an increase in numbers through to the 1960s, a subsequent decline in the late 1970s, an increase in the mid-late 1990s, and a decline to the present (Thomas & Gray 2002, Spalding 2000, Seip & Cichowski 1996, Stevenson & Hatler 1985, Bergerud 1978). These changes were more pronounced in the southern and central part of the province than in the north (i.e., within the boundaries of the SMNEA).

Limited historical population estimates are available that differentiate the subpopulations in west-central Alberta, but Alberta Sustainable Resource Development & Alberta Conservation Association (2010, and references therein) cite “a significant decline in the number and size of caribou populations in Alberta”.

3.3 Needs of the Southern Mountain Caribou

3.3.1 Habitat and biological needs

Southern mountain caribou require large range areas of relatively undisturbed, interconnected habitat where they can separate themselves (horizontally and by elevation) from predators and other prey species, modify their geographic use in response to various natural and human-caused habitat disturbances and human activities, and access their preferred food sources.

Caribou select habitat at several scales. At the landscape scale, predator avoidance is the most important factor influencing selection (Johnson et al. 2002, Gustine et al. 2006a). In the Southern Group, caribou select high elevation habitats throughout most of the year, while predators and other prey are found primarily at low elevations; the greatest degree of overlap occurs during spring (Seip 1992a, Stotyn 2008, Steenweg 2011). Spatial separation from predators and other prey is especially critical during calving and early summer when calves are most vulnerable. During calving, caribou that disperse into high elevation alpine and subalpine habitat or onto islands in lakes where predators are less abundant have higher newborn calf survival than caribou that calve below treeline (Bergerud et al. 1984, Bergerud 1985, Seip and Cichowski 1996). Females tend to return

to the same location to calve each year. At medium scales (site) and fine scales (micro-site), snow cover and food also contribute to habitat selection.

During winter, southern mountain caribou require large patches of mature and old forests with abundant lichens. Old forest supports fewer primary prey species such as moose (*Alces americanus*), elk (*Cervus elaphus*), and deer (*Odocoileus* sp.), resulting in fewer interactions with predators (e.g., wolves [*Canis lupus*], cougars [*Puma concolor*], grizzly bears [*Ursus arctos*] and black bears [*Ursus americanus*]). Old and mature forests also have good sightlines because the trees are not as dense as in younger stands, and lichens are more abundant in old and mature forests than in young forests. Subpopulations with high levels of recent disturbance and very young forests and lower levels of old growth forest on their ranges have lower survival rates (Wittmer et al. 2007).

In the Southern Group where the snowpack is deep, southern mountain caribou predominantly use high elevation mature and old subalpine forests in mid and late winter when the snowpack has hardened and where they forage on arboreal lichens (primarily *Bryoria* spp.) that they are able to reach because of the deep snowpack (Seip 1990, 1992a, Simpson et al. 1997, Hamilton et al. 2000, Terry et al. 2000, Apps et al. 2001). During early winter before snow has consolidated, they use lower elevation mature and old forests (with some subpopulations moving down into cedar/hemlock forests in valley bottoms) where they forage on arboreal lichens on fallen trees, lichen litterfall, and shrubs and forbs that remain accessible in snow wells (Seip 1992a, Mowat et al. 1998, Terry et al. 2000). Caribou in the Southern Group also use lower elevation areas during spring, but return to higher elevations where they calve and spend the summer (Seip 1990, 1992a, Simpson et al. 1997, Hamilton et al. 2000).

Southern mountain caribou of the Central and Northern groups live in relatively shallow snow areas where they forage primarily on terrestrial lichens either in low elevation mature coniferous forests or on windswept alpine slopes during winter, and summer at high elevations in mountains (Edmonds and Bloomfield 1984, Cichowski 1993, Brown et al. 1994, Terry and Wood 1999, Wood and Terry 1999, Young and Roorda 1999, Backmeyer 2000, Poole et al. 2000, Stronen 2000, Johnson et al. 2002, Szkorupa 2002, Culling et al. 2005, Jones 2007, Shepherd et al. 2007, Williamson-Ehlers 2012). Although these caribou primarily dig through the snow (crater) to access terrestrial lichens (*Cladina* spp. [preferred], *Cladonia* spp., *Cetraria* spp., and *Stereocaulon* spp.), they also forage on arboreal lichens in low elevation forests, forested wetlands, and in subalpine habitats, especially during times when snow conditions are less favourable for cratering. Many subpopulations travel long distances between winter and summer ranges, while others winter and summer within the same general area. In Alberta, some caribou in the A La Peche and Redrock/Prairie Creek subpopulations no longer use the low elevation foothills portions of their ranges where habitat disturbance is high, and instead are living in the mountains all year round (Smith 2004). Currently, adult survival is higher for caribou that live year-round in the mountains than it is for those that migrate to low elevation ranges in the foothills (Hebblewhite et al. 2010a), but overall the subpopulations are still declining (Alberta Environment and Sustainable Resource

Development, unpublished data). During spring migration, caribou generally use low elevation snow-free or low snow areas (Steventon 1996).

During spring and summer, southern mountain caribou are found mostly at high elevations although portions of some subpopulations also use low elevation habitat during summer. In the spring and summer, southern mountain caribou eat a wide variety of forbs, grasses, lichens, fungi, and the leaves of some shrubs (Simpson 1987, Seip 1990, Cichowski 1993, Thomas et al. 1996).

Southern mountain caribou require their different seasonal ranges to be connected by lands that facilitate their movement. These lands, termed 'matrix range', need to provide some forage, security from human disturbance, and a low risk of predation. Within a range, habitat connectivity allows for seasonal movement among habitats having the different resources needed to satisfy life history requirements, and allows caribou to respond to disturbance or as disturbed habitat recovers (Saher and Schmiegelow, 2005). Connectivity between southern mountain caribou ranges also allows for immigration and emigration among subpopulations, which increases gene flow, thereby helping to maintain genetic diversity and the species' consequent resilience to environmental stressors (e.g., disease, severe weather). Studies have demonstrated that isolation of subpopulations as a result of disturbance to the landscape (i.e., any form of human-caused or natural habitat alteration) can result in a significant reduction in genetic diversity (Weckworth et al., 2012). In addition, connectivity among ranges maintains the possibility of subpopulation 'rescue effects' among southern mountain caribou ranges, thereby facilitating recovery. Finally, connectivity within and among southern mountain caribou ranges will allow for movement in response to changing environmental conditions (e.g., climate change).

Southern mountain caribou require matrix habitat (see Table 4) with a low predation risk. Although caribou primarily use high elevation ranges and/or habitat types where they are spatially separated from other prey and predators (Seip 1992a, Stotyn 2008, Hebblewhite et al. 2010a, Steenweg 2011, Robinson et al. 2012, Williamson-Ehlers 2012), the habitat/prey/predator dynamics at lower elevations, and in areas adjacent to ranges, contribute to prey/predator dynamics and mortality on caribou within their seasonal ranges. The reason is that predators move beyond valley bottoms and also use higher elevations, especially during summer and fall (Whittington et al. 2011). At the broad scale, wolf predation on caribou in the Southern Group occurs primarily at low elevations (Apps et al. 2013). Although Apps et al. (2013) were unable to link localized habitat fragmentation due to forest harvesting within caribou ranges with predation on caribou, they suggest that habitat alterations function at a broader spatial scale that includes the winter ranges of primary prey outside caribou ranges.

Table 4 summarizes key biophysical components of southern mountain caribou habitat.

Table 4. Components of habitat for southern mountain caribou.

Habitat component	Southern Group¹	Central Group²	Northern Group²
High elevation spring calving/summer range	<ul style="list-style-type: none"> • high elevation alpine areas, subalpine parkland and subalpine forests 	<ul style="list-style-type: none"> • high elevation alpine areas, subalpine parkland and subalpine forests 	<ul style="list-style-type: none"> • high elevation alpine areas, subalpine parkland and subalpine forests
Low elevation spring calving/summer range	<ul style="list-style-type: none"> • Not applicable 	<ul style="list-style-type: none"> • Not applicable 	<ul style="list-style-type: none"> • islands in lakes (calving) • low elevation forested and unforested habitats
High elevation winter range	<ul style="list-style-type: none"> • subalpine parkland and subalpine forests 	<ul style="list-style-type: none"> • windswept alpine slopes • subalpine parkland and subalpine forests 	<ul style="list-style-type: none"> • windswept alpine slopes • subalpine parkland and subalpine forests
Low elevation winter range	<ul style="list-style-type: none"> • early winter ranges for caribou that live in more rugged snowfall areas, which includes old and mature cedar-hemlock forests on gentle slopes (generally <45%) 	<ul style="list-style-type: none"> • low elevation pine forests 80-250+ years in age with ground cover of terrestrial lichens 	<ul style="list-style-type: none"> • low elevation pine forests 80-250+ years in age with ground cover of terrestrial lichens
Matrix range	<ul style="list-style-type: none"> • geographical areas directly adjacent to identified caribou habitat • includes migration habitat 	<ul style="list-style-type: none"> • all habitat types and geographical areas that connect seasonal ranges, foraging patches and other significant habitat features • includes migration areas 	<ul style="list-style-type: none"> • all habitat types and geographical areas that connect seasonal ranges, foraging patches and other significant habitat features • includes migration areas

¹ Adapted from Hart and Cariboo Mountains Recovery Implementation Group (2005)

² Adapted from Northern Caribou Technical Advisory Committee (2004)

3.3.2 Limiting factors

Southern mountain caribou have a low reproductive output relative to other ungulates making them vulnerable to higher rates of mortality whether caused by predation or over-harvesting. Females typically do not produce young until three years of age and then have only one calf per year (Bergerud, 2000). In addition, while all age classes of southern mountain caribou are vulnerable to predation, calf mortality can be especially high, particularly within the first 30 days after birth (Bergerud and Elliot, 1986; Gustine

et al., 2006b). In most cases predation is the main proximate cause³ limiting southern mountain caribou population growth, since the survival of calves to one year of age is usually low and is often insufficient to compensate for annual adult mortality in declining populations (Edmonds and Smith 1991, Seip 1992b, Wittmer et al. 2005b).

Small subpopulations with few adult females (and hence few births) and low calf survival have a low potential for population growth (Bergerud, 1980; Bergerud, 2000). In addition to being affected by reproductive and mortality rates related to their age distribution, small subpopulations can be disproportionately affected by stochastic events such as avalanches, fire, and disease (e.g., the last 5 caribou in the Banff subpopulation died in an avalanche in 2009). Consequently, population growth is likely to be highly variable in small subpopulations, with an increased probability of extirpation (Caughley, 1994).

4 THREATS

4.1 Threat Assessment

There are a variety of threats that directly and/or indirectly affect southern mountain caribou and their habitat. In this strategy, threats to southern mountain caribou were assessed using the International Union for the Conservation of Nature (IUCN) Threat Calculator. In this assessment, the impact of threats only considers the direct effects on population numbers, and does not consider indirect effects. Therefore, for threats that result in habitat alteration such as industrial activities and fire, only direct impacts such as loss of forage leading to poorer caribou condition and reduced survival, or displacement to habitats where mortality due to avalanche is higher, are considered in the ranking for those threats. The indirect impacts of habitat alteration leading to altered predator/prey dynamics and higher predation rates on caribou are considered only under predation (problematic native species). Also, the threat calculator only addresses new threats that will occur within southern mountain caribou ranges in the next 10 years.

Tables 5-7 summarize threats assessed for the Northern, Central and Southern Groups respectively. Many of the threats to southern mountain caribou and their habitat are related and may interact, in which case they can have cumulative impacts that may not be evident when threats are examined individually. The overall level of threat to southern mountain caribou as based on cumulative impacts of threats calculated by the IUCN Threat Calculator are: High for the Northern Group, Very High for the Central Group, and Very High for the Southern Group.

³ the proximate cause is defined as the cause that is immediately responsible for the event (in this case, predation is what is causing caribou to die)

Table 5. Threats assessed for the Northern Group of southern mountain caribou using the IUCN Threats Calculator.

Threat		Impact ¹	Scope ²	Severity ³	Timing ⁴	Comments
1 Residential & commercial development						
1.1	Housing & urban areas	Negligible	Negligible	Slight	High	• Some impact of Houston on Telkwa and Anahim Lake on Itcha-Ilgachuz
2 Agriculture & aquaculture						
2.1	Annual & perennial non-timber crops	Negligible	Negligible	Slight	High	• Mostly hay
2.3	Livestock farming & ranching	Unknown	Small	Unknown	High	• Guide-outfitter horses grazing in backcountry • Cattle grazing and feral horses in Itcha-Ilgachuz range
3 Energy production & mining						
3.1	Oil & gas drilling	Low	Small	Slight	High	• Primarily in Graham range
3.2	Mining & quarrying	Low	Small	Slight	High	• Proposed mine(s) in Tweedsmuir range
3.3	Renewable energy	Low	Small	Moderate-Slight	High	• Windfarm potential in Graham range
4 Transportation & service corridors						
4.1	Roads & railroads	Medium	Pervasive	Moderate	High	• Expected expansion of roads due to logging, especially in Itcha-Ilgachuz and potential increase in vehicle collisions
4.2	Utility & service lines	Negligible	Restricted	Negligible	High	• Proposed oil and gas pipelines in Graham, Chase, Wolverine, and Telkwa ranges
5 Biological resource use						
5.1	Hunting & collecting terrestrial animals	Negligible	Pervasive	Negligible	High	• No licensed hunting except for Itcha-Ilgachuz, Chase and Wolverine where there is a 5 point bull restriction • Some First Nations harvest • Some poaching
5.3	Logging & wood harvesting	Medium-low	Large	Moderate-slight	High	• Increased forest harvesting expected on most ranges for mountain pine beetle salvage
6 Human intrusions & disturbance						
6.1	Recreational activities	Low	Pervasive	Slight	High	• Includes snowmobiling, all-terrain vehicle (ATV) use, backcountry skiing, hiking • Snowmobiling is a concern for Itcha-Ilgachuz, Telkwa, Rainbow, Charlotte Alplands
6.3	Work & other activities	Negligible	Pervasive	Negligible	High	• Ground surveys (e.g., geology, forestry), aerial surveys, etc.
7 Natural system modifications						

Threat		Impact ¹	Scope ²	Severity ³	Timing ⁴	Comments
7.1	Fire & fire suppression	Low	Pervasive	Slight	High	<ul style="list-style-type: none"> • Fire is a natural disturbance on low elevation winter ranges
7.2	Dams and water management/use	Negligible	Small	Negligible	High	<ul style="list-style-type: none"> • Tweedsmuir caribou migrate across the Nechako Reservoir where log debris can be extensive along some shorelines
7.3	Other ecosystem modifications	Low	Pervasive	Slight	High	<ul style="list-style-type: none"> • Increased populations of moose and deer due to habitat alteration • Mountain pine beetle disturbance on most low elevation winter ranges and spruce bark beetle disturbance in some areas
8 Invasive & other problematic species & genes						
8.1	Invasive non-native/alien species	Unknown	Unknown	Unknown	Unknown	<ul style="list-style-type: none"> • Potential for new animal diseases/parasites introduced from domestic animals, game farming or invading wildlife • Very little is known about this threat
8.2	Problematic native species	High	Pervasive	Serious	High	<ul style="list-style-type: none"> • Primary predators include wolves, bears, wolverines, cougars • Increased predation expected due to: habitat alteration within and adjacent to ranges from industrial activities (forest harvesting, mining, windfarms) and infrastructure (pipelines, transmission lines) resulting in habitats favoured by other prey such as deer and moose, which in turn sustain higher numbers of predators; and facilitated access for predators into caribou ranges from expansion of roads and other linear infrastructure, and packed trails due to winter recreational activities
10 Geological events						
10.3	Avalanches/landslides	Low	Restricted	Slight	High	<ul style="list-style-type: none"> • Avalanches are a concern for Telkwa, Chase, Wolverine and Takla
11 Climate change & severe weather						
11.1	Habitat shifting & alteration	Unknown	Unknown	Unknown	Unknown	<ul style="list-style-type: none"> • Expected increase in elevation for treeline and changes to low elevation habitats but actual change in vegetation structure not expected in the next 10 years
11.4	Storms and flooding	Unknown	Unknown	Unknown	Unknown	<ul style="list-style-type: none"> • Potential increased risk of thaw (or rain) then freezing events resulting in increased ice crusting and difficulty in accessing ground forage during winter

¹ Impact is calculated based on scope and severity. Categories include: very high, high, medium, low, unknown, negligible

² Scope is the proportion of the population that can reasonably be expected to be affected by the threat within the next 10 years. Categories include: Pervasive (71-100%); Large (31-70%); Restricted (11-30%); Small (1-10%); Negligible (<1%), Unknown. Categories can also be combined (e.g., Large-Restricted = 11-70%).

³ Severity is, within the scope, the level of damage to the species (assessed as the % decline expected over the next three generations [27 years for southern mountain caribou]) due to threats that will occur in the next 10 years. Categories include: Extreme (71-100%); Serious (31-70%); Moderate (11-30%); Slight (1-10%); Negligible (<1%), Unknown. Categories can also be combined (e.g., Moderate to slight = 1-30%).

⁴ Timing describes the immediacy of the threat. Categories include: High (continuing); Moderate (possibly in the short term [<10 years or three generations]); Low (possibly in the long term [>10 years or three generations]); Negligible (past or no direct effect); Unknown.

Table 6. Threats assessed for the Central Group of southern mountain caribou using the IUCN Threats Calculator.

Threat		Impact ¹	Scope ²	Severity ³	Timing ⁴	Comments
1 Residential & commercial development						
1.3	Tourism & recreation areas	Low	Small	Slight	High	• Potential expansion of Marmot Basin ski hill in Jasper
3 Energy production & mining						
3.1	Oil & gas drilling	Low	Pervasive	Slight	High	• Extensive in Quintette, Narraway, Redrock/Prairie Creek, A La Peche
3.2	Mining & quarrying	Medium	Large	Moderate	High	• High coal potential; expected expansion of activities in Narraway, Quintette, Redrock/Prairie Creek, A La Peche
3.3	Renewable energy	Medium-Low	Large	Moderate-Slight	Moderate	• Windfarm potential on most ranges
4 Transportation & service corridors						
4.1	Roads & railroads	Low	Pervasive	Slight	High	• Expected expansion of roads due to oil and gas, mining and logging, leading to a potential increase in vehicle collisions (vehicle collisions already a problem for A La Peche on Hwy 40)
4.2	Utility & service lines	Negligible	Restricted	Negligible	High	• Proposed oil and gas pipelines within and adjacent to most ranges
5 Biological resource use						
5.1	Hunting & collecting terrestrial animals	Negligible	Pervasive-Large	Negligible	High	• No licensed hunting • Some First Nations harvest • Some poaching
5.3	Logging & wood harvesting	Medium-Low	Large	Moderate-Slight	High	• forest harvesting occurring within and adjacent to most ranges • expected increase in mountain pine beetle salvage on low elevation winter ranges
6 Human intrusions & disturbance						
6.1	Recreational activities	Low	Pervasive	Slight	High	• Includes snowmobiling, all-terrain vehicle (ATV) use, backcountry skiing, hiking, fixed-wing and helicopter access into backcountry
6.3	Work & other activities	Low	Pervasive	Slight	High	• Ground surveys (e.g., geology, forestry), aerial surveys, etc.
7 Natural system modifications						
7.1	Fire & fire suppression	Not calculated	Small	Moderate-Slight	Low	• Fire is a natural disturbance on low elevation winter ranges • Lower risk in high elevation winter ranges where fire disturbance is infrequent
7.2	Dams and water management/use	Negligible	Small	Negligible	High	• Williston Reservoir bisects a large part of the Scott range

Threat		Impact ¹	Scope ²	Severity ³	Timing ⁴	Comments
7.3	Other ecosystem modifications	Low	Pervasive	Slight	High	<ul style="list-style-type: none"> Increased populations of moose and deer due to habitat alteration Mountain pine beetle disturbance on most low elevation winter ranges
8 Invasive & other problematic species & genes						
8.1	Invasive non-native/alien species	Unknown	Unknown	Unknown	Moderate	<ul style="list-style-type: none"> Potential infection of chronic wasting disease introduced via game farming
8.2	Problematic native species	Very High	Pervasive	Extreme	High	<ul style="list-style-type: none"> Primary predators include wolves, bears, wolverines Increased predation expected due to: habitat alteration within and adjacent to ranges from industrial activities (oil and gas, forest harvesting, mining, windfarms) and infrastructure (pipelines, transmission lines) resulting in habitats favoured by other prey such as deer and moose, which in turn sustain higher numbers of predators; and facilitated access for predators into caribou ranges from expansion of roads and other linear infrastructure, and packed trails due to winter recreational activities
9 Pollution						
9.6	Excess energy	Negligible	Pervasive	Negligible	High	<ul style="list-style-type: none"> Noise from gas plants, etc. especially in Narraway, Quintette, Redrock/Prairie Creek, A La Peche
10 Geological events						
10.3	Avalanches/landslides	Low	Small	Slight	High	<ul style="list-style-type: none"> Avalanches have been responsible for about 6% of mortality in the Jasper subpopulations; the last 5 caribou in the Banff subpopulation were killed in a single avalanche
11 Climate change & severe weather						
11.1	Habitat shifting & alteration	Not calculated	Unknown	Unknown	Low	<ul style="list-style-type: none"> Expected increase in elevation for treeline and changes to low elevation habitats but actual change in vegetation structure not expected in the next 10 years

¹ Impact is calculated based on scope and severity. Categories include: very high, high, medium, low, unknown, negligible

² Scope is the proportion of the population that can reasonably be expected to be affected by the threat within the next 10 years. Categories include: Pervasive (71-100%); Large (31-70%); Restricted (11-30%); Small (1-10%); Negligible (<1%), Unknown. Categories can also be combined (e.g., Large-Restricted = 11-70%).

³ Severity is, within the scope, the level of damage to the species (assessed as the % decline expected over the next three generations [27 years for southern mountain caribou]) due to threats that will occur in the next 10 years. Categories include: Extreme (71-100%); Serious (31-70%); Moderate (11-30%); Slight (1-10%); Negligible (<1%), Unknown. Categories can also be combined (e.g., Moderate to slight = 1-30%).

⁴ Timing describes the immediacy of the threat. Categories include: High (continuing); Moderate (possibly in the short term [<10 years or three generations]); Low (possibly in the long term [>10 years or three generations]); Negligible (past or no direct effect); Unknown.

Table 7. Threats assessed for the Southern Group of southern mountain caribou using the IUCN Threats Calculator.

Threat		Impact ¹	Scope ²	Severity ³	Timing ⁴	Comments
2 Agriculture & aquaculture						
2.1	Annual & perennial non-timber crops	Negligible	Negligible	Slight	High	•
2.3	Livestock farming & ranching	Negligible	Small	Negligible	High	• Mostly due to horses; some cattle grazing
3 Energy production & mining						
3.1	Oil & gas drilling	Negligible	Negligible	Unknown	Moderate	• Shale gas potential in the Kootenays in the long term
3.2	Mining & quarrying	Low	Small	Moderate	High	• Mostly in the Barkerville, Kootenay and Kamloops areas
3.3	Renewable energy	Low	Restricted-Small	Moderate	Moderate	• Potential for independent power projects (e.g., run of the river) in the Columbia South and Columbia North ranges
4 Transportation & service corridors						
4.1	Roads & railroads	Medium-Low	Pervasive	Moderate-Slight	High	• Several subpopulations already cross busy roads (e.g., Highway 3, Mica Dam road) • Potential twinning of the Trans-Canada Highway
4.2	Utility & service lines	Low	Small	Slight	High	• Potential transmission lines for independent power projects • Potential twinning of the Kinder-Morgan oil pipeline
5 Biological resource use						
5.1	Hunting and collecting terrestrial animals	Negligible	Pervasive	Negligible	High	• No licensed hunting • Potentially some First Nations harvest • Some poaching
5.3	Logging & wood harvesting	Medium-Low	Large-Restricted	Moderate-slight	High	• Most forest harvesting expected in valley bottoms but some high elevation habitat will also be affected, especially in the Revelstoke area
6 Human intrusions & disturbance						
6.1	Recreational activities	Low	Pervasive	Slight	High	• Includes snowmobiling, heli-skiing (including flight paths to and from ski areas), cat-assisted skiing, all-terrain vehicle (ATV) use, backcountry skiing, hiking • Primary concerns are snowmobiling and heli-skiing
6.2	War, civil unrest & military exercises	Negligible	Negligible	Serious-Moderate	High	• Mt Revelstoke/Glacier areas military run avalanche control
6.3	Work & other activities	Negligible	Large	Negligible	High	• Ground surveys (e.g., geology, forestry), aerial surveys, avalanche control, etc.

7 Natural system modifications						
7.1	Fire & fire suppression	Low	Small	Moderate-slight	High	<ul style="list-style-type: none"> • Generally lower risk in high elevation winter ranges where fire disturbance is infrequent; however, several large fires have burned high elevation range in the southern area
7.2	Dams and water management/use	Negligible	Small	Negligible	High	<ul style="list-style-type: none"> • Existing reservoirs may reduce dispersal
7.3	Other ecosystem modifications	Low	Pervasive	Slight	High	<ul style="list-style-type: none"> • Increased populations of moose and deer due to habitat alteration • Some concern about mountain pine beetle and spruce bark beetle disturbance at low elevations
8 Invasive & other problematic species & genes						
8.2	Problematic native species	Very High	Pervasive	Extreme	High	<ul style="list-style-type: none"> • Primary predators include wolves, bears, wolverines, cougars • Increased predation expected due to: habitat alteration within and adjacent to ranges from industrial activities (forest harvesting, mining) and infrastructure (pipelines, transmission lines) resulting in habitats favoured by other prey such as deer and moose, which in turn sustain higher numbers of predators; and facilitated access for predators into caribou ranges from expansion of roads and other linear infrastructure, and packed trails due to winter recreational activities
10 Geological events						
10.3	Avalanches/landslides	Medium	Large	Moderate	High	<ul style="list-style-type: none"> • Avalanches have been responsible for 23% of mortalities in the Revelstoke area
11 Climate change & severe weather						
11.1	Habitat shifting & alteration	Unknown	Pervasive	Unknown	High	<ul style="list-style-type: none"> • Expected increase in elevation for treeline and changes to low elevation habitats but actual change in vegetation structure not expected in the next 10 years

¹ Impact is calculated based on scope and severity. Categories include: very high, high, medium, low, unknown, negligible

² Scope is the proportion of the species that can reasonably be expected to be affected by the threat within the next 10 years. Categories include: Pervasive (71-100%); Large (31-70%); Restricted (11-30%); Small (1-10%); Negligible (<1%), Unknown. Categories can also be combined (e.g., Large-Restricted = 11-70%).

³ Severity is, within the scope, the level of damage to the species (assessed as the % decline expected over the next three generations [27 years for southern mountain caribou]) due to threats that will occur in the next 10 years. Categories include: Extreme (71-100%); Serious (31-70%); Moderate (11-30%); Slight (1-10%); Negligible (<1%), Unknown. Categories can also be combined (e.g., Moderate to slight = 1-30%).

⁴ Timing describes the immediacy of the threat. Categories include: High (continuing); Moderate (possibly in the short term [<10 years or three generations]); Low (possibly in the long term [>10 years or three generations]); Negligible (past or no direct effect); Unknown.

4.2 Description of Threats

Threats are described below in descending order of direct impact to southern mountain caribou population trend (Tables 5-7).

4.2.1 Predation

(IUCN# 8.2 Problematic native species)

The most significant, immediate threat to all three Groups of southern mountain caribou is increased predation resulting from habitat alteration due to industrial activities (Tables 4-6). Industrial activities such as forest harvesting, mining and mineral exploration and development, and oil and gas exploration and development remove or destroy southern mountain caribou habitat (mature and old forests) and create early seral⁴ habitats favoured by other prey species such as moose and deer. Because wolf populations are sustained by moose and deer (Seip 1992b, Stotyn 2008, Williamson-Ehlers 2012), increased numbers of those prey species support higher numbers of wolves than would occur naturally in ecosystems dominated by older forest ecosystems. Although southern mountain caribou may not be the main target prey species, they are taken opportunistically when encountered. In ranges with habitat alterations that provide favourable conditions for other prey species, predators such as wolves can increase in number, which can significantly reduce or even eliminate southern mountain caribou subpopulations (Seip, 1991; Seip, 1992; Wittmer et al., 2005b).

Predation risk is also affected by roads and linear features associated with industrial and recreational activities. In the Central Group, encounter rates between wolves and caribou increased with proximity to linear features (Whittington et al. 2011). In the Southern Group, wolf predation on caribou occurs in association with roads at the fine scale (Apps et al. 2013).

Wolves are the primary predator of southern mountain caribou (Edmonds 1988, Seip 1992b, McNay 2009, Whittington et al. 2011), but bears, cougars, and wolverine can be locally and/or seasonally important. Cougars and bears are a significant source of mortality for some subpopulations in the Southern Group (Kinley and Apps 2001, Wittmer et al. 2005b, Stotyn 2008) and bear and wolverine predation are important sources of mortality in some Northern Group subpopulations (Cichowski and MacLean 2005, McNay 2009).

4.2.2 Industrial activities (habitat alteration)

(IUCN #3.1 Oil and gas drilling, 3.2 Mining and quarrying, 3.3 Renewable Energy, 5.3 Logging and Wood Harvesting)

Although the impacts of industrial activities do not generally result in direct mortality of southern mountain caribou, indirect impacts include facilitated movement of predators through

⁴ early seral refers to the condition of habitat that occurs directly after disturbance; early seral habitats are generally composed of grasses, forbs, shrubs and seedling trees.

caribou ranges and altered predator/prey dynamics due to habitat alteration, which lead to increased predation rates on caribou. Where infrastructure is involved (e.g., oil and gas wells, roads) or habitat is converted to other uses (e.g., agriculture), habitat alteration is permanent. Even temporary alteration due to forest harvesting can take 60-80 years for fire-adapted forests and over 100 years for high elevation subalpine habitat or low elevation cedar-hemlock forests to become suitable habitat for southern mountain caribou. Industrial activities can also affect caribou directly through impacts on forage lichens (Kranrod 1996, Sulyma 2001, Miège et al. 2001, Stevenson and Coxson 2007).

Habitat alteration resulting from industrial activities on southern mountain caribou ranges has been linked to: reduced spatial separation between caribou and other prey or predators (Peters 2010); reduced range occupancy (Smith *et al.* 2000, Apps and McLellan 2006, Wittmer *et al.* 2007); reduced adult caribou survival (Smith 2004, Wittmer *et al.* 2007); and population declines (Wittmer *et al.* 2007).

The effects of habitat alteration due to industrial activities may reduce the viability of a southern mountain caribou subpopulation through the reduction of habitat quality and quantity. This may lead to a reduction in the size of the range and potentially result in the extirpation of a subpopulation. In any given range, habitat disturbance due to industrial activities reduces the suitability of adjacent habitat (Smith et al., 2000; Williamson-Ehlers 2012). In some cases southern mountain caribou may use areas of inadequate or degraded habitat (e.g., buffer habitat surrounding certain types of development), particularly in highly disturbed ranges where opportunities for movement to suitable undisturbed habitat are limited or unavailable (Williamson-Ehlers et al. 2013). In these situations southern mountain caribou are at a higher mortality risk. In addition, large-scale industrial disturbances to the landscape (e.g., widespread forest harvesting) can cause southern mountain caribou to discontinue their use of portions of the range (Smith et al. 2000).

Forest harvesting and mineral exploration and development occur throughout the SMNEA. Coal exploration and development, oil and gas exploration and development, and windfarms are primarily a threat to subpopulations in the Central Group. In addition, independent power projects (IPPs) have been proposed in ranges of the Southern Group. These IPPs will affect low elevation spring and early winter cedar-hemlock forests.

4.2.3 Roads and other linear features

(IUCN # 4.1 Roads and railroads, 4.2 Utility and service lines)

Roads impact caribou directly through vehicle collisions and increased access for regulated and unregulated hunting (Brown and Ross 1994). Mortality due to vehicle collisions has been an issue for the A La Peche subpopulation (Central Group), but most subpopulations in the SMNEA experience no or extremely low levels of this type of mortality.

Roads and linear features such as pipelines, seismic lines, and hydro transmission lines also affect southern mountain indirectly through habitat fragmentation and potentially by improving the efficiency of movement for some predators. Southern mountain caribou avoid roads and

other linear features (Oberg 2001, Hebblewhite et al. 2010a, DeCesare et al. 2012, Williamson-Ehlers 2012) and avoidance extends well beyond the actual development footprint (Williamson-Ehlers et al. 2013).

4.2.4 Recreational activities

(IUCN #6.1 Recreational activities)

Recreational activities that affect southern mountain caribou include: snowmobiling, heli-skiing, cat-assisted skiing, alpine/downhill skiing, backcountry skiing/snowshoeing, ATV use, hiking and hunting of other species. Recreational activities can affect caribou through displacement (Seip et al. 2007, Wilson and Hamilton 2003), increased levels of stress (Freeman 2008), and creation of packed trails during winter that facilitate predator access to caribou habitat. Displacement could force caribou into areas where mortality risk is higher. Increased levels of stress hormones have been found in caribou up to 10 km away from winter recreational activities (Freeman 2008). Continued stress could lead to poor body condition and potentially lower survival and reproductive rates (Simpson and Terry 2000).

Snowmobiling and heli-skiing are significant recreational activities in southern mountain caribou ranges in the Southern Group. Snowmobiling is also a significant activity in many subpopulation ranges in the Central and Southern groups.

4.2.5 Natural disturbances (habitat alteration)

(IUCN #7.1 Fire and fire suppression, 7.3 Other ecosystem modifications)

Fire and forest insects are the primary natural disturbances on low elevation winter ranges of southern mountain caribou in the Northern and Central groups. Fire can directly alter habitat through loss of mature conifer stands, lichens and other forage plants, and by creating barriers to movement. Indirectly, fire converts mature and old forests into early seral habitat favoured by moose and deer. Historically, when disturbance from a wildfire occurred, southern mountain caribou would shift their use of habitat from affected areas to areas that are more suitable. However, with the increase of industrial activities, in most ranges there are fewer available suitable areas into which southern mountain caribou can move. When combined with human-caused disturbance, fire can threaten southern mountain caribou recovery even though it is a natural component of the forest ecosystem.

The recent mountain pine beetle (*Dendroctonus ponderosae*) epidemic has affected most low elevation winter ranges in the SMNEA. Although initially dwarf shrub abundance increased and terrestrial lichen abundance declined following mountain pine beetle attack (Cichowski et al. 2008, 2009, Seip and Jones 2010, Waterhouse 2011), abundance of dwarf shrubs has since declined and terrestrial lichen abundance has increased slightly. Despite reduced terrestrial lichen abundance and a reduced canopy, southern mountain caribou continue to use beetle-killed stands to crater for terrestrial lichens (Cichowski 2010, Seip and Jones 2010).

4.2.6 Hunting

(IUCN #5.1 Hunting and collecting terrestrial animals)

Licensed hunting is closed for southern mountain caribou, with the exception of three Northern Group subpopulations (Chase, Wolverine, Itcha-Ilgachuz). Hunting for those subpopulations is regulated using hunting season length and a minimum 5-point bull size restriction. First Nations subsistence hunting occurs in some areas. The extent of unlicensed hunting is not known but suspected to be low for most subpopulations.

4.2.7 Other Threats

Other threats that have a lower level of concern for all southern mountain caribou (although they may be of greater concern for individual subpopulations) include:

Climate change (IUCN# 11.1 Climate change – habitat shifting and alteration): The long-term effects of climate change and the implications on southern mountain caribou and their habitat are unknown. Greater weather variability and severe weather events are expected to increase with climate change and are likely to: increase the frequency and severity of wildfires and forest insect outbreaks; cause more freeze-thaw cycles, freezing rain, deep snow, hot summer temperatures; and, result in changes to forest composition and food supply (Vors and Boyce, 2009). Although climate change is not expected to result in major habitat shifts in the short term, climate-related changes in habitat are expected to favour deer and other prey species, increasing predator populations and predation on southern mountain caribou, and facilitating the spread of disease. Climate change may result in habitat change for southern mountain caribou, as it drives sub-boreal forests to shift northwards and subalpine forests to shift upslope.

Avalanches (IUCN# 10.3 Avalanches/landslides): Avalanches are a known cause of southern mountain caribou mortality, especially in the Southern Group. In the Central Group, the last five caribou in the Banff subpopulation were killed in an avalanche in 2009 (Hebblewhite et al. 2010b), and an avalanche killed some caribou in the Brazeau subpopulation.

Parasites and Diseases (IUCN# 8.1 Invasive non-native/alien species): Viral, parasitic, and bacterial diseases can affect individual southern mountain caribou and may have effects at the subpopulation level, although it is not thought to be one of the major threats affecting southern mountain caribou.

Noise and Light Disturbance (IUCN# 9.6 Excess energy): Noise and light disturbance result in short-term behavioural and physiological responses of individual southern mountain caribou, including a startle response, elevated heart rate, and increased production of stress hormones. Sustained or repeated disturbance can result in avoidance of areas and the reduction in use of suitable habitat.

5 POPULATION AND DISTRIBUTION OBJECTIVES

5.1 Recovery Goal

The recovery goal for southern mountain caribou is to achieve self-sustaining populations in all local population units within their current distribution, to the extent possible.

The recovery goal reflects the best available information and is informed by the scientific principles of conservation. Recovery for southern mountain caribou focuses on the local population unit level rather than the subpopulation level because local population units address the fragmented distribution of currently recognized subpopulations and the need for connectivity between subpopulations. Current evidence supports the conclusion that the recovery of southern mountain caribou is biologically and technically feasible.

5.2 Population and Distribution Objectives

To guide recovery efforts, the population and distribution objectives are, to the extent possible, to:

- stop the decline in both size and distribution of all local population units;
- maintain or increase the current distribution of southern mountain caribou within all local population units; and
- increase the size and distribution of all local population units to self-sustaining levels and, where appropriate and attainable, to levels which can sustain a harvest with dedicated or priority access to aboriginal peoples.

Local population units are considered to be “self-sustaining” when:

- the local population unit on average demonstrates stable or positive population growth over the short term (≤ 20 years), and is large enough to withstand random events and persist over the long term (≥ 50 years), without the need for ongoing active management intervention; and,
- there is no reduction in the number of caribou within local population units that currently consist of over 100 caribou, and there is an increase to at least 100 caribou within local population units that currently consist of fewer than 100 caribou.

The number of caribou in most local population units has recently declined. Therefore, the potential for ranges within local population units to support caribou is higher than what is reflected by current population sizes. Population targets for achieving recovery based on recent capacity for ranges to support caribou are: 4600 caribou for the Northern Group, 2000 caribou for the Central Group, and 2500 caribou for the Southern Group.

5.3 Timelines to Recovery

Southern mountain caribou exist in mature forest ecosystems that evolved over centuries, and that in turn take decades to recover from disturbance. Reversing ecological processes detrimental to southern mountain caribou (e.g., habitat degradation and loss, the increase in

predator and alternate prey populations), and instituting changes to management frameworks and ongoing land use arrangements, will often require timeframes in excess of 50 to 100 years. Given these realities, while it is currently biologically and technically feasible to recover all local population units under the best efforts of all parties, some local population units are unlikely to return to self-sustaining status for a number of decades.

For several southern mountain caribou local population units, immediate actions to avoid extirpation are needed such that recovery can be achieved over time. Recovery will be monitored continuously and reported every five years (see Section 8).

5.4 Prioritizing Recovery Actions and Managing Risk

All local population units are included in the goal for the recovery of southern mountain caribou based on their contributions to connectivity, representativeness and redundancy. Each local population unit also faces different challenges to maintain or achieve self-sustaining status. Successful recovery of southern mountain caribou will require practical considerations and implementation of recovery actions tailored for each local population unit. Prioritization of recovery actions is best addressed at the action planning stage where the allocation of effort and the rate of risk reduction for individual local population units can best be determined.

Action planning will consider a multitude of information and factors, such as regional ecological conditions, local population unit size and trend, caribou movement between ranges, habitat condition between ranges, distribution of resources for restoration efforts, and others. In prioritizing recovery actions, consideration should be given to the current risk of extirpation of a local population unit, the length of time to achieve self-sustaining status, ecological needs of connectivity, representativeness and redundancy, as well as population and habitat conditions.

For southern mountain caribou local population units that are declining, stabilizing the local population unit by halting its decline will require immediate action. Although certain local population units with fewer than 100 animals may be stable and persist over the short term where adequate suitable habitat is available, the long-term persistence of those populations is less certain. In some instances, continued human intervention may be required to achieve the minimum population size target. For the Southern and Central groups, if a local population unit becomes extirpated, recovery of the local population unit will need to be achieved by increasing neighbouring local population units such that they expand into the extirpated range, or by reintroduction. Currently, none of the populations within those two groups is viable enough to sustain removals of animals for augmentations or re-introductions to other ranges, but sufficient numbers may be achievable via captive breeding.

6 BROAD STRATEGIES AND GENERAL APPROACHES TO MEET OBJECTIVES

6.1 Actions Already Completed or Currently Underway

Federal and provincial governments, Aboriginal people, non-government organizations, and affected industries in British Columbia and Alberta have taken a range of actions to manage and protect southern mountain caribou and their habitat. Examples of actions already completed or currently underway include:

- identification and delineation of southern mountain caribou ranges and habitats within ranges;
- assessment of the population size and/or trend and/or distribution of subpopulations of southern mountain caribou in Canada and straddling the Canada-U.S. border;
- consideration of southern mountain caribou habitat requirements when planning and implementing forest harvesting and other industrial activities, including prohibition of forest harvesting and road building activities in 2.2 million ha to protect high suitability habitat for southern mountain caribou in the Southern Group in BC;
- consideration of southern mountain caribou habitat when planning and implementing prescribed fires in national parks, including conducting prescribed fires in areas away from caribou habitat to maintain a safe distance between caribou and predators;
- closure to snowmobiling of 1 million ha of high elevation habitat within ranges of southern mountain caribou in the Southern Group in BC;
- cessation of the setting of early season ski tracks that lead into caribou winter range, and periodic seasonal trail and road closures in national parks;
- development and implementation of operating guidelines for industrial development within southern mountain caribou ranges;
- land-use planning to identify areas within southern mountain caribou ranges where southern mountain caribou conservation is prioritized;
- voluntary cessation of hunting by Aboriginal people;
- hunting closures for most southern mountain caribou subpopulations and restrictions in areas that remain open to hunting;
- reduced speed zones on highways in important caribou habitat;
- predator and alternate prey management projects in some ranges where subpopulations of southern mountain caribou are declining;
- development of cooperative stewardship agreements, memoranda of understanding, and activities to support the engagement of Aboriginal organizations, recreational stakeholders, and other stakeholders in the monitoring, management, and conservation of southern mountain caribou;

- preparation of outreach materials on southern mountain caribou and dissemination to interest groups, recreational organizations, and the general public;
- education of park visitors on how to avoid disturbing caribou; and,
- research on southern mountain caribou ranges, habitat, ecology and limiting factors.

Collectively, these actions, and the level of commitment associated with these actions, are an encouraging foundation upon which to build. Table 7 outlines the status of provincial and federal recovery planning initiatives for southern mountain caribou.

Table 8. Status of southern mountain caribou recovery planning in provincial and federal jurisdictions where southern mountain caribou occur.

Provincial/ Federal Jurisdiction	Recovery Document	Recovery Objective
British Columbia	<ul style="list-style-type: none"> • A Strategy for the Recovery of Mountain Caribou in British Columbia (2002) 	<ul style="list-style-type: none"> • A viable metapopulation of 2500-3000 mountain caribou distributed throughout their current range in BC.
	<ul style="list-style-type: none"> • Implementation Plan for the Ongoing Management of Southern mountain caribou in British Columbia, 2011 (Southern Group) 	<ul style="list-style-type: none"> • Decrease rate of decline • Reduce risk of extirpation for four populations within 50 years
	<ul style="list-style-type: none"> • Implementation Plan for the Ongoing Management of South Peace Northern Caribou (<i>Rangifer tarandus caribou</i> pop. 15) in British Columbia, 2013 (Central Group) 	<ul style="list-style-type: none"> • Increase the population of the South Peace populations of mountain caribou to ≥ 1200 animals within 21 years.
Alberta	<ul style="list-style-type: none"> • A Woodland Caribou Policy for Alberta, June 2011 (Central Group) • Alberta Woodland Caribou Recovery Plan, 2004/5 – 2013/14 (Central Group) 	<ul style="list-style-type: none"> • Self-sustaining populations and maintain distribution • Ensure long-term habitat requirements within ranges
Federal	<ul style="list-style-type: none"> • Conservation Strategy for Southern Mountain Caribou in Mountain National Parks, November 2011 (Central Group, Southern Group) 	<ul style="list-style-type: none"> • Achieve an ecologically functioning local population of southern mountain caribou in Banff and Jasper National Parks through maintenance of herds of 25-40 animals within historic range within and adjacent to the parks and ecologically connected to adjacent populations. • Maintain Southern Mountain caribou on the landscape in and around Mount Revelstoke and Glacier National Parks
	<ul style="list-style-type: none"> • Technical Compendium to the Conservation Strategy for Woodland Caribou (<i>Rangifer tarandus caribou</i>), Southern Mountain Population, on Parks Canada Lands, September 2011 (Central Group, Southern Group) 	<p>Jasper:</p> <ul style="list-style-type: none"> • Increase or maintain local populations of southern mountain caribou to a level that restores natural population processes (e.g., dispersal, migration). • Maintain at least 500 southern mountain caribou in Jasper National Park over the next 100 years, spread among the 4 currently occupied regions in the park. <p>Banff:</p> <ul style="list-style-type: none"> • Achieve a local population of 25-40 southern mountain caribou in the short term (10-15 years) within current and historic range in and adjacent to Banff National Park, include the North Saskatchewan drainage south to the Trans-Canada Highway, the Siffleur Wilderness area and adjacent provincial lands.

		<ul style="list-style-type: none"> • Maintain the local population of 25-40 southern mountain caribou over the long term (15-50 years), with occurrence of interchange of animals between local population in Banff and south Jasper National Parks. <p>Mount Revelstoke and Glacier:</p> <ul style="list-style-type: none"> • In collaboration with partners, maintain caribou persistence. • In collaboration with partners, maintain and/or increase connectivity of caribou habitat.
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6.2 Strategic Direction for Recovery

Table 9 and the following and narrative describe the broad strategies and general approaches, as well as research and management activities, to be taken to achieve the population and distribution objectives for southern mountain caribou. Strategies and approaches are often interrelated and details on their implementation and their level of priority will differ by local population unit and habitat condition. Timing of specific recovery actions and their level of priority will be outlined and addressed in subsequent action plans (see Section 9). The overall approach is to conduct population management actions in the short term, concurrent with habitat restoration activities, until suitable habitat is restored.

Table 9. Recovery planning table for southern mountain caribou

Threat or Limitation	Priority ¹	Broad Strategy to Recovery	General Description of Research and Management Approaches
Mortality and Population Management			
Predation	Urgent	Manage predators and primary prey	<ul style="list-style-type: none"> • Where necessary, apply predator management as a management tool coordinated with other management approaches (e.g., habitat restoration and management, management of primary prey populations), to achieve southern mountain caribou local population unit growth. • Where applicable, consider effective indirect predator management techniques as an alternative to direct predator management (e.g., limiting predator access to seasonal ranges, maternal penning to protect newborn calves in selected southern mountain caribou subpopulations). • Where mortality and/or population management is being implemented, monitor southern mountain caribou subpopulations and consider monitoring the effects on other impacted species.

Threat or Limitation	Priority ¹	Broad Strategy to Recovery	General Description of Research and Management Approaches
Hunting	Medium	Manage direct human-caused mortality of southern mountain caribou	<ul style="list-style-type: none"> • Determine the extent of current hunting where it occurs, and the effects of hunting on southern mountain caribou subpopulations. • In consultation with Aboriginal people, develop and implement harvest strategies, where required to achieve southern mountain caribou recovery. • Assess and address impacts of hunting regulations for all southern mountain caribou ranges that overlap with other legally hunted Woodland Caribou ecotypes. • Reduce illegal hunting through stewardship, education and enforcement.
Roads and linear features	Medium	Manage vehicular traffic and road maintenance	<ul style="list-style-type: none"> • Where applicable, develop highway zoning and operations guidelines to minimize potential collisions between caribou and vehicles
Small local population unit size	Medium	Augment / reintroduce caribou	<ul style="list-style-type: none"> • Consider augmenting local population units if caribou are available from viable source subpopulations or captive breeding programs. • Consider reintroducing caribou into unoccupied areas if threats have been addressed and caribou are available from viable source subpopulations or captive breeding programs.
Landscape Level Planning			
Predation Industrial activities (habitat alteration) Roads and linear features Natural disturbance (habitat alteration)	Urgent	Undertake landscape level protection and planning that considers current and future southern mountain caribou habitat requirements	<ul style="list-style-type: none"> • Develop an action plan for each Group that outlines population and habitat management activities with measurable targets to achieve the recovery goal. • Undertake coordinated land and/or resource planning to ensure that development activities are planned (type, amount, and distribution) and implemented at appropriate spatial and temporal scales (e.g., consider sensitive periods/areas such as movements between seasonal ranges, calving, etc.). • Plan to maintain habitat within and between southern mountain caribou ranges, to maintain connectivity where required. • Undertake coordinated planning among provincial, federal and international jurisdictions that jointly manage ranges (i.e., provincial trans-boundary ranges, provincial-National Parks, Canada-U.S boundary) to reach agreement on the overall strategic direction for local population unit recovery. • Develop range-appropriate cumulative effects assessment approaches. Southern Mountain caribou ranges on the west-side of the Rocky Mountain divide may require different approaches than ranges on the east-side because of the different patterns of seasonal range use by local populations units utilizing the west vs. east-slopes. • Communicate among governments, Aboriginal communities and organizations, non-governmental organizations, and other organizations responsible for land and/or resource management and/or conservation within the southern mountain forest to ensure coordination of planning and management and, where applicable, facilitate cross-jurisdictional cooperation and implementation.

Threat or Limitation	Priority ¹	Broad Strategy to Recovery	General Description of Research and Management Approaches
Habitat Management			
Predation Industrial activities (habitat alteration) Roads and linear features Natural disturbance (habitat alteration)	Urgent	Manage habitat to meet current and future habitat requirements of southern mountain caribou	<ul style="list-style-type: none"> • Protect key high elevation summer and winter areas for southern mountain caribou through appropriate habitat management and protection mechanisms (e.g., legislated protected areas, no development zones, and conservation agreements). • Undertake coordinated actions to reclaim southern mountain caribou habitat in all utilized seasonal ranges through restoration efforts (e.g., restore industrial landscape features such as roads, old seismic lines, pipelines, cut-lines, temporary roads, cleared areas; reconnect fragmented ranges) to make it less suitable for other prey species. • Measure and monitor disturbance on the key components of southern mountain caribou habitat. Update action plans to reflect changes in habitat condition. • Where seasonal ranges are highly disturbed, identify areas that will be prioritized for southern mountain caribou recovery and targeted for early habitat reclamation. Incorporate management guidelines and actions into permitting conditions for activities identified as affecting southern mountain caribou or their habitat. • For ranges that are jointly managed (i.e., provincial transboundary, international transboundary), undertake collaborative habitat management among responsible federal, provincial and international jurisdictions and agencies to ensure equitable efforts are underway. • Encourage stewardship of southern mountain caribou habitat among industries, interest groups, and Aboriginal communities and organizations. • Assess the impact of natural disturbance (e.g., forest fire, Mountain Pine Beetle) on the long-term habitat management of southern mountain caribou ranges. Where necessary, incorporate short- and long-term southern mountain caribou habitat considerations, along with other considerations, into fire management and silvicultural planning. • Monitor habitat and use adaptive management to assess progress and adjust management activities as appropriate.
Recreational Activities			
Recreational activities Predation	Urgent	Manage access and timing of recreational activities in caribou habitat to minimize trails and caribou displacement.	<ul style="list-style-type: none"> • Assess effectiveness of current regulations and guidelines in minimizing the impacts of recreational users on caribou. • Where needed, in consultation with recreational stakeholder groups and provincial and federal agencies, develop recreational use plans that minimize impacts on caribou.
Population Monitoring			

Threat or Limitation	Priority ¹	Broad Strategy to Recovery	General Description of Research and Management Approaches
Knowledge gaps: Population dynamics (trends, size, structure, and distribution)	High	Conduct population studies to better understand population structure, trends and distribution	<ul style="list-style-type: none"> • Where necessary, refine understanding of the structure and functioning of southern mountain caribou subpopulations and local population units. • Collect population information (size, trend, etc.) for a minimum of two years in local population units where population condition is unknown, or has not been collected for more than five years. • Establish a baseline population size and trend (i.e., population condition) estimate for each local population unit. • Monitor population size and/or trend, as well as changes in southern mountain caribou distribution over time and in relation to habitat condition and disturbance. • Coordinate data collection, data-sharing, and planning between or among neighbouring federal, provincial and international jurisdictions to establish and refine transboundary ranges where appropriate. • Conduct operational trials of mortality management (maternal penning) and where feasible population enhancement (augmentation) options to test risks and effectiveness.
Knowledge gaps: climate change	Medium	Monitor climate regimes and frequency of climate-related disturbances and effects on habitat condition	<ul style="list-style-type: none"> • Coordinate monitoring of climate-related events with provincial and federal programs assessing ecosystem vulnerability to climate change to develop a better understanding of the habitat conditions on each range.
Knowledge gaps: southern mountain caribou sensory disturbance	Medium	Monitor and manage sensory disturbance of southern mountain caribou	<ul style="list-style-type: none"> • Assess the extent, distribution, and possible consequences of sensory disturbance (e.g., aircraft traffic, snowmobiles, all-terrain vehicles, tourism, research, and the equipment associated with industrial exploration and development) on southern mountain caribou, and where required reduce its effects, particularly during sensitive periods (e.g., seasonal range migrations, calving). • Minimize disturbance to southern mountain caribou during monitoring and research programs, and select monitoring and research techniques that are the least intrusive.
Knowledge gaps: southern mountain caribou health and condition	Low-medium	Monitor southern mountain caribou health and condition	<ul style="list-style-type: none"> • Gather information on the health and body condition of individual southern mountain caribou when handling animals or investigating mortalities.

Priority: reflects the level of priority of the broad strategy for all southern mountain caribou. This priority for each local population unit may differ.

6.3 Narrative to Support the Recovery Planning Table

Recovery of southern mountain caribou will require the commitment, collaboration and cooperation among federal, provincial and international jurisdictions, Aboriginal people, local communities, landowners, industry and other interested parties. It will be important to monitor

habitat conditions, and the distribution, size and trends of southern mountain caribou local population units so that the effectiveness of individual caribou range management regimes can be evaluated and adjusted as necessary. It will take time for the impact of human developments and natural disturbances, and/or population and habitat restoration activities on southern mountain caribou populations to become evident. Therefore, action plans must take into account the likelihood of a delayed southern mountain caribou population and distribution response to human-caused or natural habitat alterations and restoration activities, and include short-term management actions to prevent further declines.

6.3.1 Mortality and Population Management

6.3.1.1 Manage Predators and Their Primary Prey

Human-induced habitat alterations have upset the historic balance between southern mountain caribou and their predators, resulting in unnaturally high predation rates in many southern mountain caribou ranges. As a result, in some ranges predation rates are much higher than can be sustained and are unlikely to decline unless habitat recovers. A population management approach involving management of other wildlife species (i.e., predators and their primary prey) is likely required in the short term to stop southern mountain caribou declines and stabilize some local population units to prevent their extirpation. Where the condition of the local population unit warrants such measures, management of predators and their primary prey may be applied as interim management tools until habitat conditions in the range recover. Where mortality management is applied, concurrent application of other management tools will be needed to achieve recovery.

In particular, habitat restoration and management will be necessary to recover the seasonal range conditions and predator densities necessary to maintain southern mountain caribou local population units. Management of predators and their primary prey should be considered simultaneously. Primary prey management applied in the absence of concurrent predator management has the potential to be harmful to southern mountain caribou conservation. Predator management without concurrent primary prey management and habitat restoration also may not be effective. Predator management through increased hunting of predators has been implemented in some southern mountain caribou ranges, but may not be sufficient to achieve southern mountain caribou population size and trend targets. More direct predator management programs may be necessary in the short term to halt southern mountain caribou declines.

6.3.1.2 Manage Direct Human-Caused Mortality of Southern Mountain Caribou

Licensed hunting is closed for all but three southern mountain caribou subpopulations. Where hunting occurs, it is important to monitor the level of hunting within a range in order to understand the potential impact of hunting on the viability of a local population unit. Attention should also be given to areas where southern mountain caribou ranges overlap with northern mountain caribou, where licensed hunting is permitted, and hunting regulations for northern mountain caribou should be modified as appropriate. In areas where hunting both occurs and is shown to have a negative effect on local population viability, harvest strategies should be

developed, in consultation with Aboriginal people, to achieve southern mountain caribou recovery.

6.3.1.3 Augment/reintroduce caribou

For some local population units with small population sizes, investment in intensive management options (e.g., maternal penning, augmentation) may be required to achieve recovery goals. Where threats have been addressed in unoccupied areas, re-introductions may be possible. A captive breeding program may be considered where viable sources for augmentation or re-introduction are not available.

6.3.2 Landscape Level Planning

Since it is the local population unit that has been identified as the most relevant scale at which to plan for the conservation of southern mountain caribou, landscape level planning should be used for addressing the cumulative effects of habitat disturbance and for managing disturbance. Action planning for southern mountain caribou should consider current and future human developments and determine detailed management activities that are tailored to the conditions of the ranges and the subpopulations in question. Action plans should take into account natural disturbances and cumulative effects of development within and between southern mountain caribou local population units.

It will be important to undertake coordinated planning to ensure that planned developments take into consideration the cumulative impacts of all current and future developments within a local population unit. Assessing cumulative effects will require a different approach for larger continuous units than for smaller discrete ranges or where seasonal movements of caribou are concentrated. For larger units, dividing the large areas into smaller management units may allow land managers to better understand where the disturbance is occurring and thus avoid irreversible range retraction and permanent breaks in range connectivity.

Because actions taken in one range may impact neighbouring ranges, it will be important that provincial and federal agencies take a collaborative approach to planning, particularly with jointly managed ranges (e.g., transboundary ranges).

6.3.3 Habitat Management

Southern mountain caribou ranges will need to be managed to ensure their current and future ability to support self-sustaining local population units. The effectiveness of various management activities may vary between and within local population units due to differences in the population condition and specific local conditions.

Management of the amount, type and distribution of human developments will be necessary. Both human-caused and natural disturbances will need to be monitored and measured. Methods may vary in accordance with the information and tools available to the provinces and federal agencies involved. Disturbed areas may need to be improved or restored to support population and distribution objectives within each southern mountain caribou range. Maintaining

connectivity within and between habitat patches and local population units will be particularly important for southern mountain caribou throughout their distribution. In certain cases, it may be necessary to identify and designate protected areas with biophysical attributes for southern mountain caribou. For those local population units that are jointly managed by provinces and federal governments (i.e., transboundary ranges), collaborative habitat management approaches will be necessary to ensure that compatible recovery efforts are underway. Though ranges may cross provincial and international boundaries, each jurisdiction remains accountable for activities carried out in their own portion of a local population unit.

6.3.3 Managing Recreational Activities

Increasing recreational use of back-country areas both within and outside protected areas has been recognized both provincially and federally as an important ecosystem and species conservation concern. Hiking, skiing (back-country, heli-skiing, downhill ski resorts), snowshoeing, snowmobiling, and off-road vehicle access increase opportunities for predators to access caribou habitat and may also displace caribou. Currently, protected areas have guidelines in place for managing the timing and extent of recreational use during sensitive seasons or in areas where movements by caribou are restricted. For a number of local population units, the annual extent of recreational use is poorly known. Because use of remote areas for recreation is expected to increase, there is a need to develop additional guidelines and management plans for protecting caribou habitat.

6.3.4 Population Monitoring

6.3.4.1 *Conduct Population Studies to Better Understand Southern Mountain Caribou Population Structure, Trends and Distribution*

There is considerable variation in the present level of understanding of southern mountain caribou subpopulation condition, structure and trends across their distribution. While accurate population size and trend estimates are available for most subpopulations, for others, size and trend estimates are based on limited or out-of-date data. For subpopulations where little current information is known, baseline population ecology studies (such as southern mountain caribou collaring, aerial observations/counting, and on the ground monitoring activities) are required to establish a baseline from which to plan and measure recovery progress. For all subpopulations, population size and trends, and caribou distribution, should be monitored over time to test the efficacy of management actions and adapt those management actions as appropriate.

Data to assess the effectiveness of alternative management measures to improve population dynamics (e.g., maternal penning, predator management/control, augmentation) comes from only a few studies, some of which have combined several measures in a single study (e.g., Smith and Pittaway 2011, Chisana Caribou Recovery Team 2010). Effectiveness reviews of carefully monitored operational trials are essential for assessing their utility for halting declines and developing action plans.

6.3.4.2 Conduct Studies to Better Understand Climate Change on Southern Mountain Caribou

The currently predicted effects of climate change in montane species include shifting phenologies among plant species, changing availability of access to forage through shifting snowpack depth and hardness, and, altered severity and timing of storm events creating hazards such as avalanches, rain-on-snow events, disturbances (e.g., fires) or intense storms during sensitive periods. Longer-term effects may include elevational shifts in availability of food on winter/summer ranges, shifts in distribution of other animals and plants, and changing successional pathways for forest and range vegetation communities. It is not well known how these effects may interact with southern mountain caribou movements and population dynamics, especially when populations are small. The assessment and monitoring of climate regimes and climate-related effects on caribou use of habitat, coupled with predicted shifts in vulnerability to climate-mediated disturbance and habitat dynamics, will be important in both action planning and monitoring of local population unit recovery.

6.3.4.3 Monitor and Manage Sensory Disturbance of Southern Mountain Caribou

The extent, distribution and effects of various sources of sensory disturbance (e.g., low-flying aircraft, snowmobiles, equipment associated with various industries and recreational users) on individual southern mountain caribou and southern mountain caribou subpopulations should be assessed and managed in conjunction with provincial and federal regulations and guidelines. Where required, additional management actions to reduce the effects of sensory disturbance on southern mountain caribou should be implemented and the effectiveness of the management actions should be monitored over time and adapted as necessary.

6.3.4.4 Monitor Southern Mountain Caribou Health and Condition

Parasites and disease can affect individual southern mountain caribou and may have effects at the local population unit level in certain parts of their distribution. Pollution from oil and gas contaminated sites has also been shown to negatively affect the health of southern mountain caribou and may result in mortality if individuals consume toxins at waste sites. However, little is known about the severity of parasites, disease and pollution to individual southern mountain caribou or to southern mountain caribou subpopulations. Therefore, information on the health and body condition of southern mountain caribou should be assessed when handling animals. This would assist in better understanding the relationship between these threats and the viability of subpopulations, and the determination if there is a need for additional recovery actions.

7 CRITICAL HABITAT

Under SARA, habitat is defined for wildlife as:

- the area or type of site where an individual or wildlife species naturally occurs or depends on directly or indirectly in order to carry out its life processes or formerly occurred and has the potential to be introduced;

and, critical habitat is defined as:

- the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species.

For southern mountain caribou, critical habitat identification describes the habitat that is necessary to maintain or recover self-sustaining local population units throughout their distribution. In many of the areas identified as critical habitat, the quality of habitat will need to be improved for recovery to be achieved.

As a general overview of their habitat needs, southern mountain caribou occupy ranges consisting of highly diverse topography, terrain types, and environmental conditions. Typically, southern mountain caribou undertake elevational and horizontal movements between seasonal ranges in response to changing food availability and environmental conditions (e.g., snow depth, snow hardness). Consequently, three principal range components have been identified for southern mountain caribou:

- high elevation summer and winter range (all Groups);
- low elevation winter range (Northern and Central Groups); and,
- matrix range surrounding summer and winter ranges (for most but not all local population units in all Groups).

Although southern mountain caribou use each of these range components differently, the most significant habitat requirement of all three range components is a low predation risk. In the Southern Group, caribou spend most of their time in high elevation summer and winter range, but matrix range within and outside of their ranges supports predators that are sustained by other prey and that also kill caribou. Low elevation cedar-hemlock forests used by some subpopulations in early winter and spring are included in matrix range. In the Central Group, recent population declines have resulted in range use being increasingly restricted to high elevation summer and winter ranges although there is empirical evidence and aboriginal traditional knowledge indicating historic use of low elevation winter range and matrix range. Some subpopulations in the Central Group still use both high elevation summer and winter range as well as low elevation winter range. In the Northern Group, most subpopulations are relatively less affected by population decline and so all three range components are used; matrix habitat is used more by this Group than the other Groups, especially during migration periods.

High elevation subalpine and alpine ranges are typically climax-type ecosystems that experience infrequent fire disturbance events. Low elevation winter ranges in the Central and Northern Groups are more dynamic ecosystems experiencing naturally occurring periodic disturbances by fire and other disturbance agents. Low elevation winter ranges are therefore expected to tolerate some level of habitat alteration while high elevation summer and winter ranges are not expected to be as tolerant.

See Table 4 for information on the components of habitat (ranges) and Appendix C for information on biophysical attributes of critical habitat.

7.1 Identification of Critical Habitat for Southern Mountain Caribou

Critical habitat for southern mountain caribou is partially identified for all local population units as:

The ranges within each local population unit that contain the biophysical attributes required by southern mountain caribou to carry out its life processes, with the following thresholds:

- all of the area of high elevation winter and/or summer range;
- within the Northern and Central Groups that contain low elevation winter range, a perpetual state of a minimum of 65% undisturbed habitat in order to provide an overall ecological condition that will allow for an ongoing recruitment and retirement cycle of habitat;
- matrix range that provides an overall ecological condition that will allow for low predation risk, defined as wolf population densities less than 3 wolves/1000 km²;

Existing anthropogenic features (including maintained trails, roads and existing infrastructure (e.g., buildings), agricultural fields) are not identified as critical habitat, even when they occur within the indicated polygon.

Habitat disturbance⁵ leads to increased populations of moose and deer, which prefer early seral habitats, with a consequent increase in the number of individual predators. Additionally, linear features associated with human-caused disturbance can lead to greater predator efficiency. Much of a southern mountain caribou's annual cycle is spent in high elevation summer and/or winter range where natural disturbances such as fire are uncommon. Predation risk tends to be low in those ranges because predators spend most of their time in valley bottoms. Calving at high elevations is thus an important anti-predator strategy for caribou. Consequently, disturbance at high elevations that leads to increased predation risk will contribute to caribou declines and hinder achievement of the recovery objectives. While a minimum threshold of disturbance necessary for recovery in high elevation habitat has not yet been determined, it is apparent that management of high elevation critical habitat should seek to minimize disturbance.

A threshold of 65% minimum undisturbed habitat was identified as a target disturbance level to guide habitat recovery actions for boreal caribou (Environment Canada 2012) based on methodology developed by Environment Canada (2011). This target threshold was associated with a policy-based choice of a 60% probability that a boreal caribou population would be self-sustaining at this 65% level of disturbance (Environment Canada 2012). There is no such analysis for southern mountain caribou. However, since the boreal caribou ranges and the southern mountain caribou low elevation winter ranges for the Northern and Central Groups all consist of fire-adapted ecosystems, the threshold of 65% undisturbed habitat has been chosen as a reference disturbance level for identifying critical habitat for southern mountain caribou low elevation winter ranges. The precise location of the 65% undisturbed habitat within the low elevation winter range will vary over time. The habitat within the low elevation winter range

⁵ For critical habitat, disturbance is defined as the area affected by human-caused disturbance, including a 500 m buffer around the disturbance to account for avoidance by caribou (see Environment Canada 2011), and the area affected by fire disturbance, avalanches, etc.

should exist in an appropriate spatial configuration including large areas of contiguous undisturbed habitat such that southern mountain caribou can move throughout their low elevation winter range and access required habitat when needed. The key to this identification of critical habitat is achieving and maintaining an overall, ongoing condition that allows for the dynamic habitat supply system, with the biophysical attributes upon which southern mountain caribou depend, to operate.

This strategy considers at this time that very minimal disturbance for high-elevation winter and/or summer ranges in all Groups, and at least a 65% undisturbed habitat level for low elevation winter ranges in the Northern and Central Groups, are required for achieving recovery of local population units. However, these disturbance levels alone are not sufficient for recovery in most local population units. Although caribou in some local population units rarely use matrix range, the condition of matrix range is also crucial to the survival and recovery of southern mountain caribou. Altered predator/prey dynamics occurring in response to increased levels of disturbance in matrix range can lead to increased predation on caribou.

Wilson (2009) recommended that wolf densities for local population units in the Southern Group be managed to <1.5 wolves/1000 km² to generate a significant, positive population response by southern mountain caribou. Hebblewhite et al. (2007) suggested that subpopulations of caribou in Jasper National Park are likely to persist when wolf densities are below 2.1-4.3 wolves/1000 km². In the absence of scientific studies defining a maximum density of wolves in matrix range across all southern mountain caribou local population units, the habitat condition necessary for the recovery of southern mountain caribou for matrix range is defined as a wolf density of <3 wolves/1000 km², based on a combination of Wilson (2009) and Hebblewhite et al. (2007). Options for achieving this outcome include reducing the amount of disturbed habitat, and reducing abundances of other prey and/or predators.

7.1.1 Components of Critical Habitat

The identification of critical habitat for southern mountain caribou is comprised of three components for each local population unit: i) Location of habitat; ii) Amount of habitat; and iii) Type of habitat.

Location

Location describes where critical habitat is found. For southern mountain caribou the relevant scale to identify critical habitat is the delineated local population unit, which shows the area within which critical habitat is located. There are 24 local population units within the current distribution of the southern mountain caribou (see Figure 1 and Table 3).

Detailed maps depicting the location of critical habitat have not been prepared to date, due to the availability of information. Maps of local population units, protected areas, and other land management designations having some relevance to caribou are shown for each Group (Northern, Central and Southern) in Appendix B. The local population unit boundaries are the areas within which critical habitat is located. Detailed maps of critical habitat will be prepared

for each local population unit as the information becomes available and will be included in a revised recovery strategy, or in one or more action plans.

Amount

Amount describes the quantity of critical habitat within the range of a local population unit that is needed for the unit to be self-sustaining.

This recovery strategy identifies as critical habitat: all habitat in high elevation summer and winter range; a minimum of 65% undisturbed habitat in low elevation winter ranges for the Northern and Central Groups; and matrix range which allows predator density consistent with performance indicators.

As explained above, the choice of a minimum of 65% undisturbed habitat in low elevation winter ranges for the Northern and Central Groups as the disturbance management threshold is taken from a relationship developed for boreal caribou, which provides a measurable probability (60%) for a boreal caribou population to be self-sustaining. This threshold is considered a minimum threshold because at 65% undisturbed habitat there remains a significant risk (40%) that local populations will not be self-sustaining at this level of disturbance, given uncertainties and the effects of random events. This threshold will be revisited once studies determining an appropriate threshold for southern mountain caribou (SMC) have been completed.

Habitat disturbance within low elevation winter range for the Northern and Central Groups needs to be managed by the responsible jurisdiction at a level that will allow for a local population unit to be self-sustaining. As there is variation in habitat and population conditions between southern mountain caribou local population units in the Northern and Central Groups, it may be necessary that some low elevation winter ranges be managed to a target above the 65% undisturbed habitat threshold, while for others it may be possible to manage the range below the 65% undisturbed habitat threshold. However, prior to any adjustment of this threshold in an amended recovery strategy or in an action plan, there must be strong evidence from population data collected over an extended period of time to support the management decision to establish a lower range-specific threshold. For example, the lag effects of disturbance on a local population unit's population condition would have been considered and assessed.

In order to meet the recovery goal, additional critical habitat may need to be identified and/or restored, depending on the level of disturbance.

- In low elevation winter ranges with less than 65% undisturbed habitat, critical habitat includes that which is currently suitable as well as adjacent habitats that over time would contribute to the attainment of 65% undisturbed habitat.
- In low elevation winter ranges with 65% or more undisturbed habitat, critical habitat includes at least 65% undisturbed suitable habitat in a range, recognizing that habitat will change over time given the dynamic nature of the forest in low elevation ranges.

- In high elevation winter and/or summer ranges, critical habitat includes that which is currently suitable as well as adjacent habitat that over time would become suitable by minimizing disturbance.

Type

Type describes the biophysical attributes of critical habitat.

Biophysical attributes are the habitat characteristics required by southern mountain caribou to carry out life processes. Information from habitat selection analyses and published reports were used to summarize the biophysical attributes of seasonal habitats necessary for southern mountain caribou (see Appendix C).

7.2 Schedule of Studies

A schedule of studies is required under SARA where available information is inadequate to identify critical habitat. The schedule of studies outlines the essential studies required to identify the critical habitat necessary to meet the population and distribution objectives for southern mountain caribou set in this recovery strategy.

As described above, the threshold of a minimum of 65% undisturbed area for low elevation winter ranges for Northern and Central Groups is taken from analyses of boreal caribou ranges. While this information provides a useful starting point to support recovery, further study is required to determine range specific disturbance thresholds for southern mountain caribou. Additional study is also required to determine the level of undisturbed habitat on high elevation ranges that is necessary to meet the recovery objectives.

Not all range components are presently mapped, particularly in the Northern and Central Groups. Although much of the high elevation summer and winter range in the Southern Group is included in existing mapping, additional known habitat has yet to be mapped.

The following schedule of studies (Table 10) is required to complete the identification of critical habitat for the three Groups of southern mountain caribou.

Table 10. Schedule of studies required to complete the identification of critical habitat for southern mountain caribou.

Description of Activity	Rationale	Timeline
Complete mapping for high elevation summer/winter range in Northern and Central Group local population units including current disturbances. Complete habitat mapping for southern mountain caribou in national and provincial parks where gaps still exist. Complete mapping of all high elevation summer and winter range for local	A common attribute standard and mapping is essential for planning management activities for recovery and developing action plans.	2014

population units in the Southern Group.		
Assess the data available to develop seasonal range specific disturbance thresholds for southern mountain caribou.	While best available evidence indicates that the disturbance threshold estimates developed for boreal caribou may be relevant to low elevation forested winter range, no specific analyses have been undertaken for southern mountain caribou. This would assist in developing action plans.	Review of data (historical, current) is required to estimate a seasonal-range disturbance threshold by mid-2014. If sufficient data exist to estimate a scientifically defensible threshold, then do the analysis by end 2014.

7.3 Activities Likely to Result in the Destruction of Critical Habitat

SARA requires that a recovery strategy identify examples of activities likely to destroy critical habitat. Destruction is determined on a case by case basis. Destruction would result if part of the critical habitat were degraded, either permanently or temporarily, such that it would not serve its function when needed by southern mountain caribou. Destruction may result from a single activity, multiple activities at one point in time, or from the cumulative effects of one or more activities over time (Government of Canada, 2009). In most cases, maintenance of existing anthropogenic features will not be considered destruction of critical habitat.

Activities that are likely to result in the destruction of critical habitat, include, but are not limited to, the following:

- Any activity resulting in the direct loss of southern mountain caribou critical habitat. Examples of such activities include: conversion of habitat to agriculture, mines, and industrial and infrastructure development.
- Any activity resulting in the degradation of critical habitat leading to a reduced, but not total loss of both habitat quality and availability for southern mountain caribou. Examples of such activities include: forestry cut blocks, pollution, drainage of an area, and flooding.
- Any activity resulting in the fragmentation of habitat by human-made linear features. Examples of such activities include: road development, seismic lines, pipelines, and hydroelectric corridors.
- Any activity resulting in displacement of southern mountain caribou from part or all of their seasonal ranges and/or from key biophysical attributes of those ranges that is sufficient to cause a reduction in their movements and/or reproductive success, or to lead to higher mortality leading to range retraction or population decline.
- Any activity that increases predator density in critical habitat (e.g., alteration of habitat to conditions favourable to other ungulates).

- Any activity that facilitates predator access to and within critical habitat (e.g., snowmobiling, snowshoeing, backcountry skiing).

A single project/activity may or may not result in the destruction of critical habitat; however, when considered in the context of all current and future development activities within and among local population units, the cumulative impacts may result in the destruction of critical habitat. Mitigation of adverse effects from individual projects/activities will require a coordinated approach and management of cumulative effects within and among local population units. A cumulative effects assessment is essential to position the proposed project/activity in the context of all current and future development activities. The cumulative effects assessment will:

- assess the impact of all disturbances (human-caused and natural) at the local population unit scale;
- monitor habitat conditions, including the amount of current disturbed and undisturbed habitat, and amount of habitat being restored;
- account for planned disturbances; and
- assess the distribution of disturbance in large local population units for risk of range retraction in parts of the range.

The determination if an activity is likely to result in the destruction of critical habitat will be facilitated by an action plan. For example, an action plan would identify activities that are likely to result in direct loss, degradation, and/or fragmentation of habitat, relevant to specific local circumstances.

8 MEASURING PROGRESS

Under SARA, the competent minister must report on the implementation of a recovery strategy and the progress towards meeting its objectives every five years. Population and habitat conditions for southern mountain caribou will change over time given the changes to population demographics, ecosystem dynamics, and the manner in which the species shifts its use of the landscape over time. Most southern mountain caribou subpopulations have undergone significant declines over the last 20 years, and are at risk of further declines. Some are at high risk of extirpation within the next five years. In addition, one of the population and distribution objectives is to immediately stop the decline in both numbers and current distribution of all local population units. Due to the immediate need of actions required to halt the decline, monitoring of implementation and effectiveness should be conducted on an annual basis and reported on every five years.

Monitoring of southern mountain caribou local population units based on performance indicators will be essential in order to have the information necessary to evaluate the effectiveness of management actions and to make necessary adjustments through an adaptive management process over time.

8.1 Adaptive Management

The process of adaptive management planning and implementation acknowledges and supports the adjustment of management actions in light of new or more refined knowledge. Adaptive management identifies knowledge gaps, uncertainties, successes and failures, which are then evaluated to prioritize future information needs to improve outcomes and inform ongoing learning. As learning continues, implementation activities continue using revised and improved management actions.

The challenge of achieving the recovery goal of self-sustaining local population units of southern mountain caribou will vary by southern mountain caribou local population unit given the habitat and population conditions and management context associated within each local population unit. To ensure adaptive management is applied to southern mountain caribou recovery, cooperation with federal and provincial governments, Aboriginal people, and others involved in the conservation, survival and recovery of southern mountain caribou will be required.

8.2 Performance Indicators

The performance indicators presented below provide a way to define and measure progress toward achieving the population and distribution objectives.

The ultimate performance indicator of southern mountain caribou recovery is self-sustaining local population units throughout the entirety of their distribution in Canada. Performance indicators for this recovery strategy are that the population and distribution objectives are met for each local population unit, and that southern mountain caribou become less at risk. Recovery of all southern mountain caribou local population units is technically and biologically feasible; however given the challenges of recovery for southern mountain caribou, some local population units that are currently not self-sustaining will likely require a number of decades to return to a recovered state.

The performance indicators described below are provided as guidelines to gauge the successful implementation of the recovery strategy. More detailed performance indicators that reflect the specific local conditions (e.g., population condition, habitat condition, alternate prey/predator dynamics, mortality rates) of each southern mountain caribou local population unit will need to be developed at the action plan stage.

General:

- a) Complete action plans within three years of the posting of the final recovery strategy for southern mountain caribou (see Section 9).

Population Condition (population trend and size):

- a) Maintain current distribution of all southern mountain caribou local population units.

- b) Achieve and/or maintain a stable to increasing population trend within one generation (seven years) for all local population units, as evaluated using population estimates or other empirical data that indicate population trend is stable or increasing.
- c) Achieve a minimum of 100 animals for southern mountain caribou local population units with population estimates of less than 100 animals, or show progress towards this goal every five years.

Habitat Condition (amount and type of undisturbed habitat):

- a) For low elevation winter ranges in the Northern and Central groups with 65% or more undisturbed habitat, maintain at least 65% of the total range as undisturbed habitat that includes the biophysical attributes needed for southern mountain caribou to carry out life processes.
- b) For low elevation winter ranges in the Northern and Central groups with less than 65% undisturbed habitat, within three years identify in an action plan specific areas of existing undisturbed habitat, as well as those areas where future habitat is to be restored to an undisturbed condition.
- c) For high elevation winter and summer ranges, maintain the undisturbed habitat that includes the biophysical attributes needed for southern mountain caribou to carry out life processes.
- d) For high elevation winter and summer ranges, within three years identify in an action plan specific areas where future habitat is to be restored to undisturbed suitable condition.
- e) For matrix range with wolf population densities <3 wolves/1000 km², maintain the biophysical attributes and/or management actions needed to maintain wolf densities below this level.
- f) For matrix range with wolf population densities >3 wolves/1000 km², within three years identify in an action plan management actions (including habitat restoration) required to achieve this density.
- g) Provide measurements of disturbance for each range component that reflect the best available information, as provided by the provinces, to update the recovery strategy accordingly every five years.

9 STATEMENT ON ACTION PLANS

As required by SARA, the Minister of the Environment and the Minister Responsible for the Parks Canada Agency will complete one or more action plans under this recovery strategy. Action plans provide the public and stakeholders with details on how the recovery strategy will be implemented and will be posted on the Species at Risk Public Registry no more than three years after the posting of the final recovery strategy for southern mountain caribou.

10 GLOSSARY

Note: The following terms are defined in accordance with their use in this document.

Aboriginal Traditional Knowledge (ATK): ATK includes, but is not limited to; the knowledge Aboriginal peoples have accumulated about wildlife species and their environment. Much of this knowledge has accumulated over many generations.

Biological feasibility: recovery is determined to be biologically feasible under the following circumstances: individuals of the wildlife species that are capable of reproduction are available now or in the foreseeable future to sustain the population or improve its abundance; sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration; and primary threats to the species or its habitat can be avoided or mitigated.

Biophysical attributes: habitat characteristics required by southern mountain caribou to carry out life processes necessary for survival and recovery (see Appendix C).

Current distribution (extent of occurrence): the area that encompasses the geographic distribution of all known southern mountain caribou subpopulation ranges, based on provincial distribution maps developed from observation and telemetry data.

Disturbed habitat: habitat showing: i) human-caused disturbance visible on Landsat at a scale of 1:50,000, including habitat within a 500 m buffer of the human-caused disturbance; and/or ii) fire disturbance in the last 40 years, as identified in data from each provincial jurisdiction (without buffer).

Early seral: the condition of habitat that occurs directly after disturbance; early seral habitats are generally composed of grasses, forbs, shrubs and seedling trees

Group: a group of southern mountain caribou local population units that are ecologically and evolutionarily distinct, which correspond to COSEWIC's Designatable Units (DUs) (COSEWIC 2011). The Northern Group is made up of that portion of the Northern Mountain DU within the Southern Mountains National Ecological Area, and includes local population units in west-central and north-central BC. The Central Group is made up of local population units in the Central Mountain DU, and includes local population units in east-central BC and west-central Alberta. The Southern Group is made up of local population units in the Southern Mountain DU, and includes local population units in southeastern BC.

Local population unit: a cluster of subpopulations that reflects a likely larger historical subpopulation that has since declined and that has been fragmented into the currently recognized subpopulations; for subpopulations that are not clustered with other subpopulations into a larger local population unit, the local population unit is equivalent to the subpopulation

Proximate cause: the cause that is immediately responsible for the event (e.g., predation is what is causing caribou to die)

Range: the geographic area occupied by a subpopulation. Range is also further defined by season (e.g., winter range, summer range).

Self-sustaining local population unit: a local population unit of southern mountain caribou that on average demonstrates stable or positive population growth over the short-term (≤ 20 years), and is large enough to withstand random events and persist over the long-term (≥ 50 years), without the need for ongoing active management intervention.

Subpopulation: a group of southern mountain caribou occupying a defined area distinguished spatially from areas occupied by other groups of southern mountain caribou.

Technical feasibility: recovery is determined to be technically feasible when recovery techniques exist to achieve the population and distribution objectives or can be expected to be developed within a reasonable timeframe.

To the extent possible: current evidence supports the conclusion that the recovery of all local population units is technically and biologically feasible. There may be situations where recovery of a particular local population unit proves to be, over time and through unforeseen circumstances, not biologically or technically feasible and as such may affect the likelihood of achieving the population and distribution objectives for some local population units.

Undisturbed habitat: habitat not showing any: i) human-caused disturbance visible on Landsat at a scale of 1:50,000, including habitat within a 500 m buffer of the human-caused disturbance; and/or ii) fire disturbance in the last 40 years, as identified in data from each provincial and territorial jurisdiction (without buffer).

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APPENDIX A: EFFECTS ON THE ENVIRONMENT AND OTHER SPECIES

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that certain strategies may also inadvertently lead to environmental effects beyond the intended benefits, or have negative impacts upon other species. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the strategy itself, but are also summarized below in this statement.

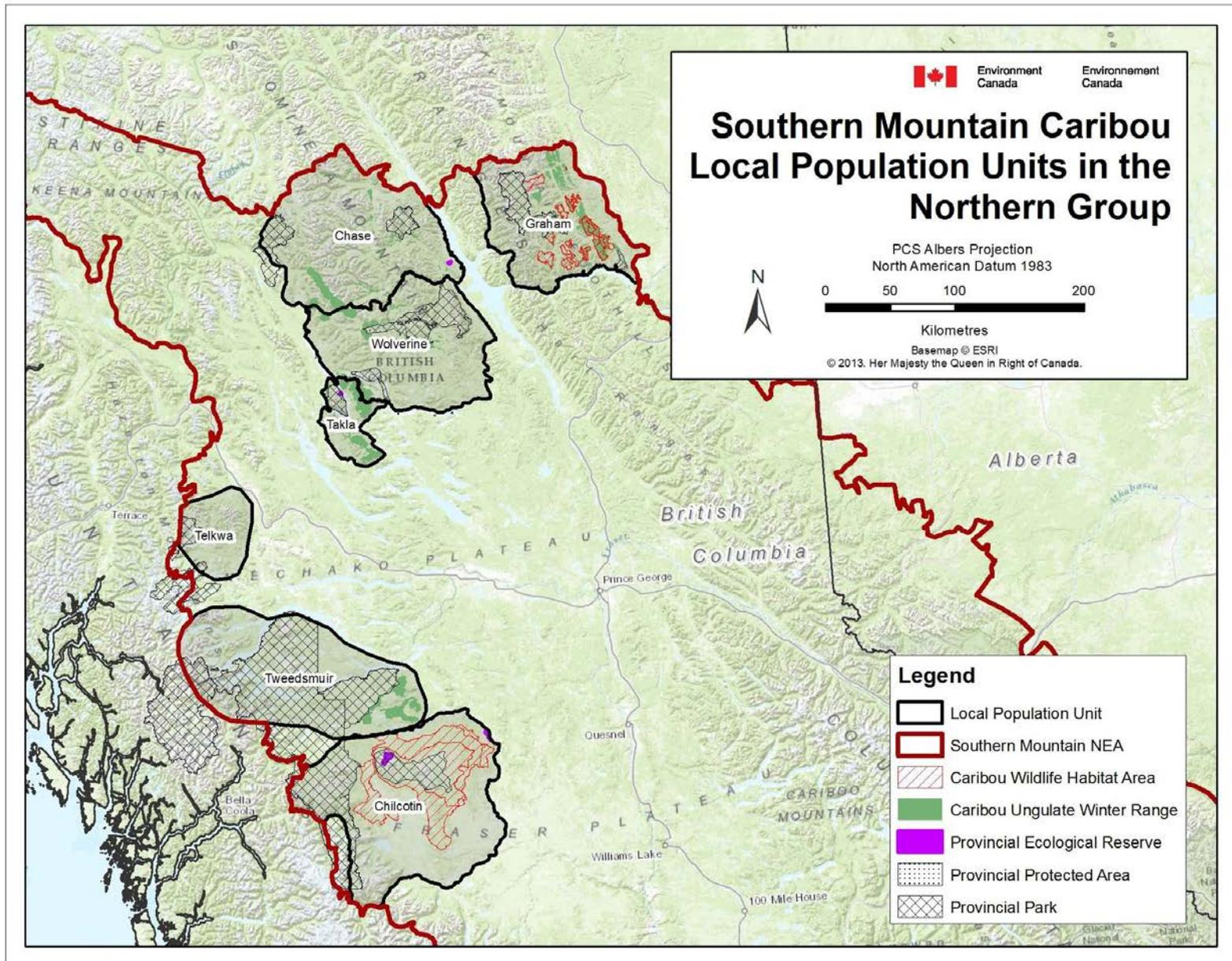
Southern mountain caribou are an umbrella species for the older-growth forest at large. There are many species that share the same habitat requirements as southern mountain caribou and will benefit from the recovery actions outlined in this recovery strategy. This recovery strategy will benefit the environment and biodiversity as a whole by promoting the recovery of southern mountain caribou and by protecting and enhancing habitat.

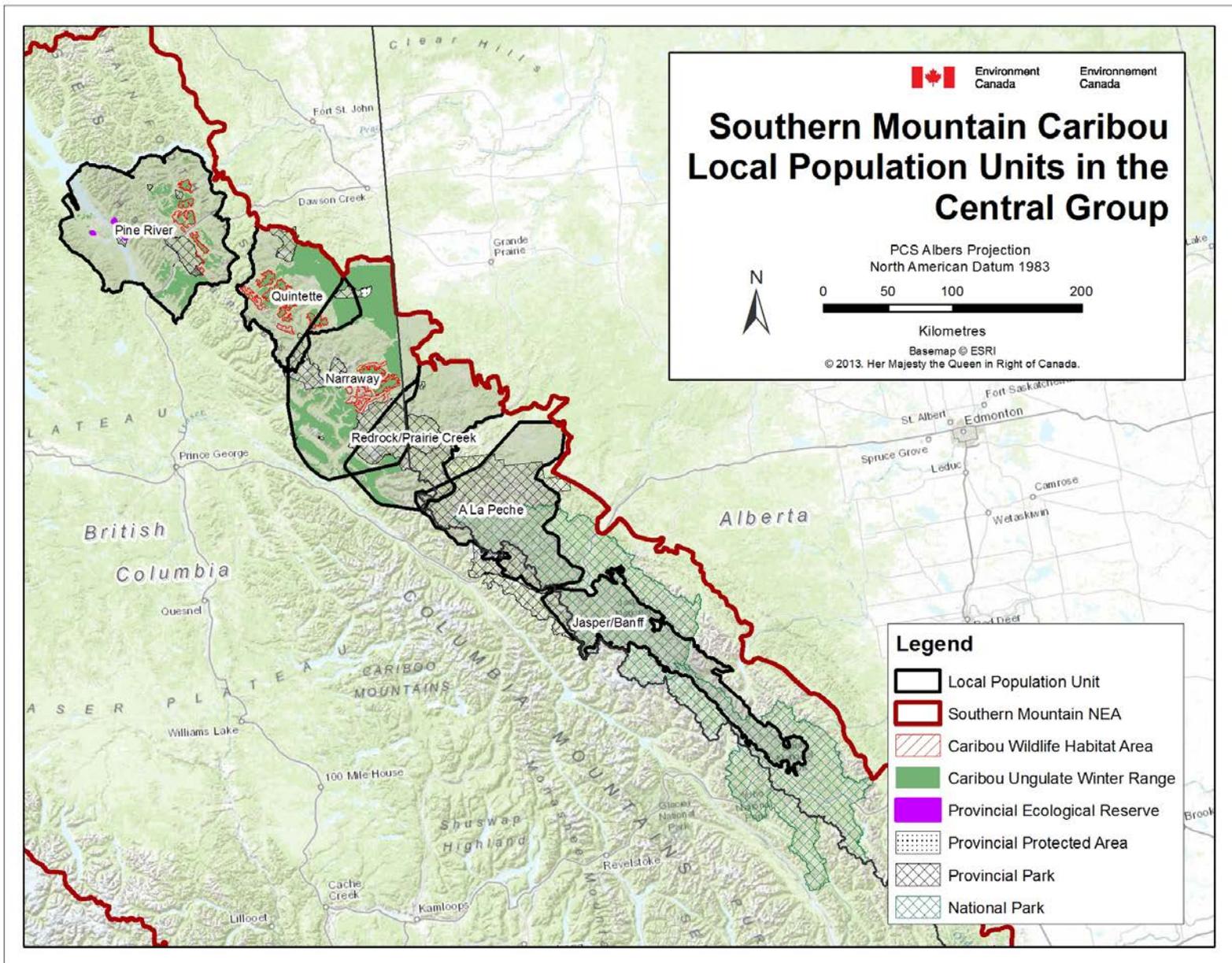
The management measures outlined in this recovery strategy are those required to halt southern mountain caribou population declines in local population units and to assist in stabilizing and recovering local population units. With respect to broader environmental impacts, certain management tools, most notably predator (e.g., wolves, bears) and alternate prey (e.g., moose, deer) management, may be required in areas with unnaturally high rates of predation on southern mountain caribou.

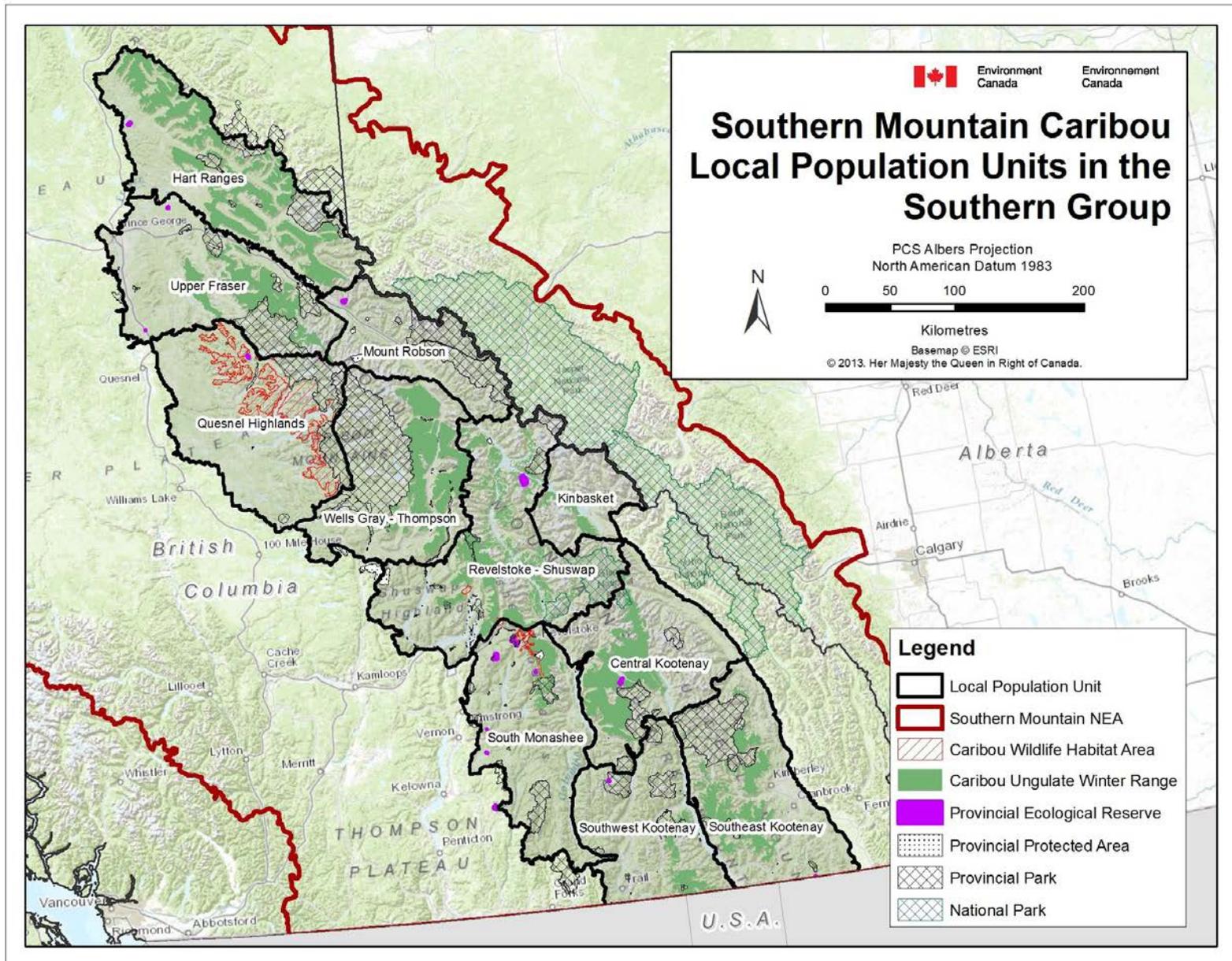
This recovery strategy acknowledges that predator and alternate prey management may be required in some local population units to help stop southern mountain caribou declines and stabilize local population units that are at risk of extirpation. Where applied, predator and alternate prey management should be used as an interim management tool, in conjunction with other management tools (e.g., habitat restoration and management) to prevent extirpation and achieve population growth. Effective indirect predator management techniques (such as actions to limit the access of predators to southern mountain caribou) should be considered prior to undertaking direct predator and alternate prey management. When a predator or alternate prey management program is being planned, the conservation status of all affected species must be considered. Where implemented, the effects of mortality management activities on southern mountain caribou local population units should be monitored.

This recovery strategy will contribute to the achievement of the goals and targets of the *Federal Sustainable Development Strategy for Canada*. In particular, the strategy directly contributes to the Government of Canada's commitment to restore populations of wildlife to healthy levels, protect natural spaces and wildlife, and protect the natural heritage of our country.

APPENDIX B: MAPS OF LOCAL POPULATION UNITS FOR THE NORTHERN, CENTRAL AND SOUTHERN GROUPS OF SOUTHERN MOUNTAIN CARIBOU







APPENDIX C: BIOPHYSICAL ATTRIBUTES FOR SOUTHERN MOUNTAIN CARIBOU CRITICAL HABITAT

Biophysical Attributes

Scientific published reports were used to summarize biophysical attributes required by southern mountain caribou to carry out life processes necessary for survival and recovery. Attributes are provided by southern mountain caribou Group in order to capture the ecological variation across the distribution of southern mountain caribou.

Biophysical Attribute Descriptions

The biophysical attributes for southern mountain caribou critical habitat are categorized by the types of habitat used by southern mountain caribou in accordance with seasonal and life-stage activity which include spring migration, calving, summer, rutting, early winter, and late winter. This information is provided in the following tables by Group.

Biophysical attributes will vary both between and within southern mountain caribou ranges. As the biophysical attributes presented in this recovery strategy were developed at the Group scale and not by subpopulation, it is anticipated that each provincial and territorial jurisdiction may have or will develop over time, a more refined description of the biophysical attributes required for each range.

Table E-1. Biophysical attributes for southern mountain caribou critical habitat in the Northern Group.

Type of habitat	Description
Spring	<ul style="list-style-type: none"> • Low elevation mature pine, pine/spruce, spruce and wetland habitats (migration routes) • High elevation alpine, subalpine parkland and subalpine forests
Calving	<ul style="list-style-type: none"> • High elevation alpine, subalpine parkland and subalpine forests with low predation risk. • Islands in lakes with low predation risk. • Portions of some subpopulations are found in lower or mid elevation forested habitats.
Summer	<ul style="list-style-type: none"> • High elevation alpine, subalpine parkland and subalpine forests. • Portions of some subpopulations are found in lower or mid elevation forested habitats during all or part of the summer.
Rutting/fall	<ul style="list-style-type: none"> • High elevation alpine, subalpine parkland and subalpine forests. • Portions of some subpopulations are found in lower or mid elevation forested habitats during all or part of the fall.
Early Winter	<ul style="list-style-type: none"> • Mature/old pine leading forests of 80 years or older with abundant terrestrial lichens, fescue/lichen meadows, wetlands, forested wetlands • Subalpine parkland and subalpine forests • Windswept alpine slopes
Late Winter	<ul style="list-style-type: none"> • Low elevation mature/old pine leading forests of 80 years or older with abundant terrestrial lichens, wetlands, forested wetlands • Low elevation black spruce fringes around wetlands (terrestrial lichens) • Low elevation mature/old mixed pine/spruce and spruce stands (arboreal lichens) • Subalpine parkland and subalpine forests (arboreal lichens) • Windswept alpine slopes (terrestrial lichens)

Type of habitat	Description
All	<ul style="list-style-type: none"> • Refuge from predators

Table E-2. Biophysical attributes for southern mountain caribou critical habitat in the Central Group.

Type of habitat	Description
Spring	<ul style="list-style-type: none"> • Low elevation mature/old pine forests away from water (migration - resting/foraging) • Habitats in less rugged terrain and close to water (migration - travelling), • High elevation alpine, subalpine parkland and subalpine forests
Calving	<ul style="list-style-type: none"> • High elevation alpine, subalpine parkland and subalpine forests with low predation risk.
Summer	<ul style="list-style-type: none"> • High elevation alpine, subalpine parkland and subalpine forests.
Rutting/fall	<ul style="list-style-type: none"> • High elevation alpine, subalpine parkland and subalpine forests.
Early Winter	<ul style="list-style-type: none"> • Low elevation mature/old pine or pine/spruce/fir mixed forests with abundant terrestrial lichens, black spruce • Subalpine parkland and subalpine forests • Windswept alpine slopes
Late Winter	<ul style="list-style-type: none"> • Low elevation mature/old pine or pine/spruce/fir mixed forests with abundant terrestrial lichens, black spruce • Subalpine parkland and subalpine forests • Windswept alpine slopes
All	<ul style="list-style-type: none"> • Refuge from predators

Table E-3. Biophysical attributes for southern mountain caribou critical habitat in the Southern Group.

Type of habitat	Description
Spring	<ul style="list-style-type: none"> • Low elevation old forests of cedar, hemlock and spruce, avalanche chutes, burns • High and mid elevation subalpine parkland and old subalpine forests
Calving	<ul style="list-style-type: none"> • High elevation alpine, subalpine parkland and old subalpine forests (females) • Low elevation old forests (males)
Summer	<ul style="list-style-type: none"> • High elevation alpine, subalpine parkland and old subalpine forests
Rutting/fall	<ul style="list-style-type: none"> • High elevation alpine, subalpine parkland and old subalpine forests
Early Winter	<ul style="list-style-type: none"> • Highland type terrain: high to mid elevation old (>140 years) subalpine forests for foraging on arboreal lichens • Rugged mountainous terrain: low elevation old (>140 years) cedar-hemlock forests for foraging on falsebox, arboreal lichen litterfall and arboreal lichens on downed trees; mid-elevation old (>140 years) spruce/subalpine fir forests for foraging on arboreal lichens
Late Winter	<ul style="list-style-type: none"> • Subalpine parkland for foraging on arboreal lichens
All	<ul style="list-style-type: none"> • Refuge from predators

Table E-4. Biophysical attributes for southern mountain caribou critical habitat in Banff and Jasper National Parks.

Type of habitat	Description
Subalpine	
Spring	<ul style="list-style-type: none"> • Select high elevations • Select broad ridges • Compared to rugged terrain, select moderately rugged terrain
Summer	<ul style="list-style-type: none"> • Select high elevations • Select westerly aspects • Select shallower slopes • Select broad ridges • Select areas with a high percentage of herbs • Select areas within 100m of open areas • Compared to coniferous forests, select herbaceous meadow and shrub meadows
Fall	<ul style="list-style-type: none"> • Select high elevations • Select westerly aspects • Select shallower slopes • Select areas close to treeline • Compared to coniferous forests, select herbaceous meadows
Winter	<ul style="list-style-type: none"> • Select high elevations • Select areas with moderate leaf area index • Select forests >150 years • Compared to rugged terrain, select moderately rugged terrain
All	<ul style="list-style-type: none"> • Areas that provide refuge from predators
Alpine	
Spring	<ul style="list-style-type: none"> • Select more moderate slopes • Select broad ridges • Select areas close to treeline • Compared to barren ground, select herbaceous and shrub meadows
Calving	<ul style="list-style-type: none"> • Select more moderate slopes
Summer	<ul style="list-style-type: none"> • Select high elevations • Select more moderate slopes • Select areas with high percentage of herbs • Select areas with high leaf area index • Select areas close to treeline • Compared to barren ground, select herbaceous and shrub meadows
Fall	<ul style="list-style-type: none"> • Select high elevations • Select westerly aspects • Select more moderate slopes • Select areas with high percentage of herbs and shrubs • Select areas close to treeline • Compared to barren ground, select herbaceous and shrub meadows
Winter	<ul style="list-style-type: none"> • Select more moderate slopes • Select areas close to treeline • Compared to barren ground, select herbaceous and shrub meadows
All	<ul style="list-style-type: none"> • Areas that provide refuge from predators

Table E-5. Biophysical attributes for southern mountain caribou critical habitat in Mount Revelstoke and Glacier National Parks.

Type of habitat	Description
Spring	<ul style="list-style-type: none"> • Low elevation old forests of cedar, hemlock and spruce, avalanche chutes, burns • High and mid elevation subalpine parkland and old subalpine forests
Calving	<ul style="list-style-type: none"> • High elevation habitat in rugged terrain (forested, subalpine, alpine) (females) • Low elevation old forests (males)
Summer	<ul style="list-style-type: none"> • High elevation habitat in rugged terrain (forested, subalpine, alpine), upper ESSF & alpine
Fall	<ul style="list-style-type: none"> • High elevation habitat
Early Winter	<ul style="list-style-type: none"> • Rugged mountainous terrain: low elevation old (>140 years) cedar-hemlock forests for foraging on falsebox, arboreal lichen litterfall and arboreal lichens on downed trees; mid-elevation old (>140 years) spruce/subalpine fir forests for foraging on arboreal lichens • Fine scale – stands with a Douglas fir component • Broad landscapes at low elevation, gentle slopes, high canopy cover closure, southerly aspects, old western hemlock and cedar
Winter	<ul style="list-style-type: none"> • High elevation, mature and old growth forest dominated by sub-alpine fir and Engelmann spruce (Subalpine parkland for foraging on arboreal lichens) • Consistent snowpack depths • Late winter – some ESSF use (below treeline) when poor weather or lower snowpacks. • Preference for low-angle slopes
All	<ul style="list-style-type: none"> • All scales – select for old forest • Broad scale – select for rugged terrain • Fine scale – select for more gentle slopes; use forest roads and clearcut edges • Areas that provide refuge from predators

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